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OF THE

AMERICAN MUSEUM OF NATURAL HISTORY.

Volume VI, 1894.

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BULLETIN

OF THE

AMERICAN MUSEUM OF NATURAL HISTORY.

Volume VI, 1894.

Article I.— ON THE BIRDS OF THE ISLAND OF TRINIDAD.

By Frank M. Chapman.

The Island of Trinidad is situated at the northeastern extremity of South America, from which it is separated by the Gulf of Paria with its passages to the sea. The southern passage, known as the Serpent's Mouth, is at its narrowest point only seven miles in width. At the northern outlet, or Dragon's Mouth, the same distance intervenes between the Venezuelan headland and Chacachacare, one of the three small islands off the northwest coast of Trinidad.

The average length of Trinidad is forty-eight miles; the average width thirty-five miles. The area, according to Wall and Sawkens, is 1734 square miles, or nearly one and one-half times that of the State of Rhode Island. The northern part of the island is mountainous, the highest peak having an altitude of 3012 feet. Two ranges of hills, running in a generally eastern and western direction, cross the island, one near the middle, the other along the southern coast. The ground between these ranges is, as a rule, rolling and watered with small streams. Only a comparatively small part of the island is under cultivation, the principal products being sugar and cacao. The area devoted to sugar is confined almost entirely to the western coast of the island, while cacao is grown in the valleys of the interior.

The year is divided into two seasons, a wet and a dry. The former generally begins in May and continues until December. The annual rainfall for the whole island, based on numerous observations extending over many years, is given by Dr. de Verteuil as 66.28 in. There is, however, apparently much variation with locality. For example, the rainfall at the Indian Walk Rest-house, at the edge of the forest, for 1891, was 126.17 in., and for 1892, 157.77 in. The latter year, however, was an exceptional one, the rainfall for the island averaging about 120 in. There is comparatively little variation in temperature throughout the year. Observations at the Botanic Gardens in Port-of-Spain show that the mean temperature at 9.30 A. M. ranges from about 78° to 84° F., and at 3.30 P. M. from 77° to 84° F.

During the dry season a fresh trade-wind blows from the eastward. During the rainy season the winds are light and variable.

With these brief introductory remarks on the principal physical and climatic characteristics of the island I proceed to a description of the localities where the collections and observations upon which this paper is based were made.

San Fernando (Feb. 23).—I reached Port-of-Spain, the principal city of Trinidad, February 21, 1893. On the night of the 22d, through the courtesy of the officers of the S. S. 'Alps' I sailed southward on that steamer and anchored the following morning off the city of San Fernando. Here, at the mouth of the Cipero River, I passed a few hours ashore. The locality is quite different from any that I subsequently visited, and brief as was my stay I met with several species which I did not afterward observe. At the entrance of the river into the gulf there are a few mangrove bushes, but a short distance from its mouth sugar-cane fields and meadows or 'savannas' appear. The following birds were seen only at this point: *Synallaxis cinnamomea*, *Leistes guianensis*, *Agelaius icterocephalus*, *Quiscalus lugubris*, *Tachycineta albiventris*.

La Brea (Feb. 23-26).—On the afternoon of the same day we steamed to La Brea and, while loading pitch from the celebrated Pitch Lake, were anchored here until the night of the 26th.

The part of the coast which I saw here is dry and sandy, and a low, dense, scrubby growth, composed largely of different species of palms, reaches to the water's edge. The locality is not a very favorable one for birds. Three species were seen here which were not elsewhere met with. They are: *Chætura polioura*, *Panyptila cayennensis* and *Myiozetetes sulphureus*.

Indian Walk Rest-house (Feb. 28–April 29).—After returning to Port-of-Spain I left on the morning of the 28th for Princestown, about 35 miles to the southward, at the terminus of the railway. Here I secured conveyance for myself and outfit and proceeded to the Indian Walk Rest-house, on the Moruga Road, seven miles southwest of Princestown and twelve miles directly north of the southern shore of the island at Moruga, a point midway between the eastern and western coasts. I resided at the rest-house from February 28 to April 29, making during this time one trip to the coast. The rest-house is a government station in charge of Corporal Stoute, who with his wife well deserves the reputation he has acquired in attending to the wants of the occasional travelers who stop at the rest-house in passing to or from the coast. It is at the border of the primæval forest, which, broken only by a bridle path and a few small clearings, stretches to the southern shore of the island. The locality is an excellent one for land-birds. The cleared ground borders the road, and is devoted to cacao groves, which are in various stages of cultivation from the newly cleared and burned fields to those containing bearing trees. In some neglected groves a growth of grass had sprung up which attracted certain Finches.

The forest is quite typical of the tropics. There is a luxuriant growth of parasitic plants, a confusing tangle of lianes, and many trees reaching to a height of 150 feet.

During the rainy season the region is well watered by numerous small streams, which at the time of my visit were for the most part dry. The varied character of the ground at the rest-house made it a most favorable point for collecting, and while many species known from the island were not seen there, I doubt if a better locality could be found for an observer whose time was necessarily limited. The average temperature during my stay was as follows:

	7 A. M.		2 P. M.		9 P. M.	
	March.	April.	March.	April.	March.	April.
Mean.	64.4	70	88	88	74	77
Highest.	74	75	92	93	78	79
Lowest.	60	65	84	78	70	74

The rainfall, as shown by the government rain-gauge, was, for March 1.85 in.; in April we had 1.82 in. from the 1st to the 22d. On the latter date the rainy season began, and from then to the 28th we had 6.22 in.

Moruga (April 21–24).—April 21 I went to Moruga, on the south coast, returning to the rest-house on the 20th. The way led through the forest and over a broken range of hills running east and west. Corn-birds (*Ostinops* and *Cassicus*), Toucans, Parrots, Plumbeous Kites, and Trogons are the characteristic birds seen in passing along this road. Smaller birds are less common than in partially cleared districts.

At Moruga there is a fine, gently sloping beach on which scarcely a shell is to be seen. At high-tide the water reaches back to rather scrubby woods, or patches of roseau palms, or beats against the precipitous sides of some sandstone headland. One of these promontories, on which were growing old forest trees, was nearly one hundred feet in height, and was being gradually washed away by the encroaching waves. Two small rivers, the Morikeet and Moruga, enter the sea at this point. Both are bordered by mangroves (*Rhizophora*) for some distance from their mouths. Large sand-flats extend from the mouth of the Moruga River, and here were observed a few small Sandpipers and Plovers. Not a Gull, Tern, nor Pelican was seen, and here, as elsewhere on the coasts, I was struck by the scarcity of seabirds. I ascended the Moruga River for some distance, but the hour was not favorable, and I saw comparatively few birds, and only one, *Aramides axillaris*, which had not been previously taken.

Caroni River (May 3).—May 1 I again reached Port-of-Spain, and early on the morning of the 3d passed several hours near the mouth of the Caroni River, which enters the Gulf of Paria a few miles south of that city. The river reaches the gulf through vast mangrove (*Rhizophora*) swamps, and these, with the mud-flats which are exposed at low-tide, are said to form the feeding ground of many water-fowl. At the time of my visit, however, these flats were covered, and beyond a few Brown Pelicans, and a number of Blue Herons (*Ardea cærulea*), White Egrets (*A. egretta*), and Green Herons (*A. cyanura*), water-birds were not abundant. *Dacnis bicolor*, which was not seen elsewhere, was common here in the mangrove bushes.

Monos Island (May 4–7).—The following morning I went to Monos Island, staying at Mr. Morrison's until May 8. The chief object of my visit was to see the famous Gúacharo caves and also to secure specimens of the Fish-eating Bat (*Noctilio leporinus*). Much to my regret I had little time left to explore the island itself, but the brief glimpse I obtained was sufficient to show me that the avifauna of Monos differs markedly from that of the vicinity of the rest-house, and indeed from that of any locality I had previously visited. The vegetation on Monos is entirely unlike that of the southern part of Trinidad. The whole island is covered with a growth of small, slender trees. The woods are rather open, and resemble a northern second-growth forest about twenty years old. It was to be expected, therefore, that many forest-loving species should be wanting, but I was not prepared to find in the short time at my command so many species not met with before. Of the twenty-six species of land-birds seen on Monos the following had not previously been observed: *Saltator albicollis*, *Spinus cucullata*, *Empidochanes cabanisi*, *Sublegatus glaber*, *Myiopatis semifusca*, *Coccyzus americanus*.

Compsothlypis pitiayumi, *Myiarchus tyrannulus*, and *Engyptila verreauxi*, birds which were exceedingly rare at the rest-house, were among the most common species at Monos. The presence of *Saltator albicollis*, *Sublegatus glaber*, and *Spinus cucullata*, species not known south of Venezuela, is perhaps due to the proximity of this part of Trinidad to the mainland, and suggests that comparison of the faunæ of northern and southern Trinidad will show a Venezuelan element in the former that is wanting in the latter, which in turn may show Guianan affinities not present in the northern part of the island.

The Faunal Position of Trinidad.—While the political divisions of the earth's surface are, as a rule, based on purely artificial boundaries, they become in time so strongly fixed in our minds that we frequently ascribe to them a significance they are far from possessing. There can be no better illustration of this than the popular idea of the geographical position of the island of Trinidad. Politically, Trinidad belongs to what are known as the British West Indies; faunally, that is naturally, Trinidad has no connection whatever with the West Indies, but is entirely South American in its affinities. Indeed, both zoölogical and geological evidence place beyond doubt the fact of its recent connection with the mainland. Looking from the northwest point of Trinidad westward past the small detached mountain-islands, Monos, Huevos, and Chacachacare, the mountains of the Venezuelan headland, distant only seven miles from the last named island, may be seen so distinctly that political lines vanish and the whole appears as it really is, a continuous mountain-chain, through whose deep valleys, due to subsidence, the sea now flows.

The continental relationships of Trinidad have been known for many years, and have often been pointed out by both zoölogists and geologists,[1] nevertheless there are many naturalists who consider Trinidad a truly West Indian island, while to the popular mind the initials "B. W. I." irrevocably decide its position. In the paper referred to Mr. Guppy places the time of the disruption of what he has termed the Parian or Northern Range, and the consequent formation of the Bocas and the Gulf of Paria, as subsequent to the close of the Miocene period. The absence of races widely differentiated from their mainland ancestors through insular isolation tends also to show that the continental connection existed at a comparatively recent time. It might be urged that the proximity of Trinidad to the mainland has prevented the complete isolation necessary for the development of new forms. I do not believe, however, that this is true.

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[1] See especially a recent paper by Mr. Guppy (Quart. Journ. Geol. Soc., XLVIII, 1892, p. 519), with whose views concerning a supposed Caribbean continent I cannot, however, agree.

The island of Cozumel is situated only twelve miles off the coast of Yucatan, but in spite of its small size and nearness to the mainland it has some sixteen peculiar forms.

Certain migratory birds, for example, *Milvulus tyrannus* (*cf.* Léotaud) annually visit Trinidad, but beyond this migration the passage of birds from the main to the island, or *vice versa*, is apparently infrequent and accidental.

We can thus in a general way determine the relationships of Trinidad to the continent, and it is therefore of special interest to note the effects of this recent insulation on the birds of the island. Unfortunately we have not as yet sufficient exact data from the adjoining main to make a satisfactory comparison, but as before stated, the relationships of the birds of the island to those of the continent are remarkably close. As far as we at present know the following species and subspecies of birds are peculiar to Trinidad or to Trinidad and Tobago :

Merula xanthosceles,
Cyclorhis flavipectus,
Chlorospingus leotaudi,
Platyrhynchus mystaceus insularis,
Myrmeciza longipes albiventris,
Momotus swainsoni,
Basileuterus vermivorus olivascens,
Lanio lawrenceii,
Sporophila lineola trinitatis,
Ramphocænus melanurus trinitatis,
Amazilia erythronota,
Pipile pipile.

Most of these birds are simply insular representatives of mainland species to which they are closely allied. They serve to show that, in spite of its comparatively recent separation and proximity to the continent, Trinidad still presents a habitat sufficiently isolated to permit of the differentiation of some of the species inhabiting it.

An analysis of the distribution of the 199 resident land-birds common to Trinidad and the continent shows that it belongs in the Colombian, rather than in the Amazonian subregion. Thus 153 of these birds are found in both Guiana and Venezuela, while twenty-five are found in Venezuela but not in Guiana, and only eleven are found in Guiana but not in Venezuela.

The relationships of Tobago to Trinidad are much the same as are those of the latter island to the mainland. Tobago was probably joined to Trinidad at the time of the continental connection previously mentioned, and its separation may have occurred at the time when, as Mr. Guppy has shown, the Bocas were formed through subsidence.

In a previous paper[1] I stated that Tobago had no birds not found in Trinidad. Subsequent investigation proves this statement to be erroneous. Most of the birds found there are identical with those of Trinidad, but the much smaller size of the island has tended to restrict the avifauna. There is an excellent opportunity here, for one familiar with both islands and their birds, to determine some of the causes which govern the distribution of species. For instance, Trinidad is exceedingly rich in Falconidæ, of which twenty-one species have been found in the island. Tobago, on the other hand, has only three species, and such common birds as *Cathartes* and *Catharista* are among the missing. Local conditions, perhaps insufficient food-supply, may be the cause in this case, but the real cause can be determined only by observation. The species found in Tobago, but which are as yet unknown from Trinidad, are the following: *Mimus gilvus*, *Chiroxiphia pareola*, *Campylopterus ensipennis*, *Centurus tricolor*, *Sittasomus olivaceus*, *Ortalis ruficauda*. These are all South American species, some of which may still be found in Trinidad.

The relationships of Grenada, the most southern of the Antilles, to Trinidad have been briefly considered in a previous paper.[1] The distinctness of its avifauna from that of Trinidad would seem to indicate that no connection has existed between the two islands.

The South American element in the avifauna of Trinidad, Tobago, and Grenada is shown by the following table, in which are scheduled only the resident South American land-birds, or their representatives, which occur in each:

	Trinidad.	Tobago.	Grenada.
Tinamidæ	1		
Cracidæ	1	1	
Columbidæ	7	4	
Falconidæ	21	3	1
Strigidæ	4		
[illegible]	5	1	

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[1] Bull. Am. Mus. Nat. Hist., Vol. IV, p. [illegible].

	Trinidad.	Tobago.	Grenada.
Cuculidæ	6	1	1
Trogonidæ	3	1	
Alcedinidæ	4	1	
Galbulidæ	1	1	
Momotidæ	1	1	
Ramphastidæ	1		
Picidæ	5	3	
Caprimulgidæ	5	3	
Cypselidæ	6	1	2
Trochilidæ	17	6	1
Formicariidæ	9	3	
Dendrocolaptidæ	11	5	
Cotingidæ	4	3	
Pipridæ	2	1	
Tyrannidæ	24	7	4
Icteridæ	8	3	1
Fringillidæ	8	4	1
Tanagridæ	18	2	1
Hirundinidæ	4		
Vireonidæ	3	2	1
Cœrebidæ	6	4	
Mniotiltidæ	3		
Troglodytidæ	2	2	1
Turdidæ	5	2	2
Total	195	65	16

Bibliography of the Trinidad Avifauna.— The first paper of importance relating to the birds of Trinidad was published in Dr. de Verteuil's 'Trinidad, its Geography, Resources, etc.,' in 1858. This, the first edition of this work, I have not seen. According to Coues (Orn. Bibl.) the ornithological matter appeared on pages 118–126 and 423–429. In the second edition[1] I believe the same matter is given on pages 89–97 and 365–381. The first article is by Dr. de Verteuil, and treats in a general way of the better known species; the second article is entitled, 'An Essay on the Ornithology of Trinidad,' by Antoine Léotaud, M.D.P. A nominal list of species is followed by some general remarks on the avifauna of the island, 'Nidification,' 'Migration,' 'Game,' 'Note and Song.'

In 1864 this was followed by a paper by Mr. E. C. Taylor[2] based on observations made between December 22, 1862, and March 24, 1863. During this time Mr. Taylor traveled over the greater part of the island, and also visited the mainland. As a result of his explorations in Trinidad, he gives an annotated list, consisting of 109 species of land-birds and nine species of water-birds. Two years later Dr. Léotaud's important work[1] appeared. Later writers (see Sclater and Finsch) have correctly estimated the value of this work to science. It was published at a time when papers on South American ornithology based on personal observations were limited in number, and Dr. Léotaud's many years of field experience gave him advantages which few ornithologists had possessed.

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[1] Trinidad: Its Geography, Natural Resources, Administration, Present Condition and Prospects. By L. A. A. de Verteuil, M.D.P.....Second Edition. Cassell & Company, Limited. London, Paris and New York. 1884. 8vo. pp. i–xi, 1–484.

[2] Ibis, 1864, pp. 73–97.

At the time when Dr. Léotaud worked the correct identification of tropical birds was possible only for a few specialists. There were no general works, and a large library was a necessary adjunct to the satisfactory determination of species. With few books at his command it was to be expected that Dr Léotaud would sometimes wrongly identify his specimens. Indeed, these errors indicate the difficulties under which he labored, and as such give evidence of the enthusiasm which enabled him to complete his work. Dr. Léotaud gave 297 species, of which 208 are land-birds and 89 water-birds. Adding to this number four species of land-birds recorded by Taylor, but not mentioned by Léotaud, the total number of species known from the Trinidad fauna in 1866 was 301.

The following year Dr. Sclater[2] published a review of Dr. Léotaud's work, in which he made some general remarks on its character, and corrected in detail a number of misidentifications.

In 1870[3] Dr. Finsch published an extended paper on Trinidad birds based on a collection of 115 species brought from the island by a captain of a vessel. In this collection Dr. Finsch found no less than ten species which had not been recorded by either Taylor or Léotaud, and, I may add, have not been met with by subsequent observers. Among this number were: *Sturnella*

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[1] Oiseaux de l'île de la Trinidad (Antilles), par A. Léotaud, Docteur en Médecine de la Faculté de Paris; Membre Correspondant de la Société de Médecine de Gand. Ouvrage publié par souscription nationale. Port d'Espagne: Chronicle Publishing Office. 1866. Roy. 8vo. pp. i-xx; 1-560; i-iv.

[2] Ibis, 1867, pp. 104-108.

[3] P. Z. S., 1870, pp. 552-589.

hippocrepis, *Icterus vulgaris*, *Cardinalis phœniceus*, *Sycalis brasiliensis*, *Ramphastos erythrorhynchus*, etc. The fact that so many conspicuous birds could have escaped the long-continued observations of Dr. Léotaud, and also that Taylor asserts specifically that some of them do not occur in Trinidad, aroused my suspicions as to the correctness of their alleged place of capture. These suspicions were more than confirmed by Sylvester Devenish, Esq., and H. Caracciolo, Esq., gentlemen well qualified to know, who informed me that previous to the recent passage of laws prohibiting the killing and exportation of birds, hundreds of thousands of bird skins were received in Trinidad from the mainland and thence reshipped to the marts of Europe for sale as millinery or decorative specimens.

It is obvious, therefore, that although a bird's skin may have come directly from Trinidad, it does not necessarily follow that the bird was killed in that island. Thus the many millinery skins existing in collections labeled with the general locality "Trinidad" or "Trinidad make," may or may not have come from Trinidad, and the doubt makes them valueless for purposes of exact comparison. In the case of Dr. Finsch this is particularly unfortunate, for he makes his collection the occasion for extended comparison between "Trinidad" birds and their representatives on the continent.

It is evident from the presence of some species, *e.g.*, *Momotus*, that some of Dr. Finsch's specimens were actually taken in Trinidad, but the presence of the species cited above makes the locality of them all open to question, and, much to my regret, I must ignore Dr. Finsch's paper in the present connection.

Dr. Finsch gives a table of thirty species, which are included in Dr. Sclater's 'Catalogue of American Birds,' as from Trinidad. The fact that twenty-six of these were not observed by either Mr. Taylor, Dr. Léotaud or myself, strengthens my opinion that many so-called 'Trinidad' birds in reality were not killed in that island. For this reason I admit no species in the following list of Trinidad birds unless its claim to rank as such is based on accurate data.

As far as I know, no other papers relating especially to the Trinidad avifauna appeared until 1884, when Mr. Ridgway published a nominal list[1] of fifteen species taken on and near Monos Island by the Naturalists of the U. S. Fish Commission S.S. 'Albatross,' from January 30 to February 2, 1884.

In the same year also a second edition of Dr. Verteuil's book appeared containing the late Dr. Léotaud's paper on Trinidad ornithology, as above mentioned.

The present paper is based primarily on collections made by myself from February 23 to May 7, 1893, under circumstances previously explained. During this time I identified 136 species of land-birds and fifteen of water-birds, of which five appear to be new to the island. In addition I am enabled to incorporate the results of an examination of Dr. Léotaud's collection of birds, which is on exhibition in the Victoria Institute, Port-of-Spain, where, through the courtesy of the authorities of the Institute, I was given every opportunity to study it. The specimens are all mounted, and, except for injury due to the continued exposure to the light, are, as a rule, in excellent condition. They are labeled with numbers corresponding to those given by Dr. Léotaud in his work, and the sex is generally given, but there is no further record. I regret that an entire absence of books, except Dr. Léotaud's, and of material for comparison, prevented my examination of these specimens being in every instance satisfactory. It was made, however, after I had practically completed my own collections, and I brought with me to the Institute specimens of the more obscure species for comparison with Dr. Léotaud's. In this way I was enabled to identify a number of Dr. Léotaud's species, the correct names of which have previously been unknown. As far as my own collections go, and in the case of North American species, my identification of Dr. Léotaud's birds may, I think, be accepted.

Additions to the Trinidad Avifauna.—The following species do not appear to have been previously recorded from Trinidad: *Dysithamnus mentalis spodionotus*, *Sclerurus albigularis*, *Sublegatus glaber*, *Myiozetetes sulphureus*, *Chlorospingus leotaudi* (sp. nov.).

Species Described as New and Changes in Nomenclature.—The following new or emended names are proposed in the present paper: *Pipile pipile* Jacq. proves not to be synonymous with *P. cumanensis* of the same author; *Myrmeciza longipes albiventris* is described as new; *Ramphocœnus melanurus trinitatis* (Less.) is given subspecific rank; *Empidochanes arenaceus* Scl. & Salv. apparently becomes a synonym of the previously described *E. cabanisi* Léotaud; the Tobagan form of this genus is described as *Empidochanes cabanisi canescens*; *Myiarchus coalei* Ridgw. is considered inseparable from *M. tuberculifer* d'Orb. & Lafr.; *Chlorospingus leotaudi*[1] and *Basileuterus vermivorus olivascens*[1] are described as new. *Cyclorhis flavipectus trinitatis* Allen is shown to be a synonym of *C. flavipectus* Scl.; and *Troglodytes tobagensis* Lawr. is not considered separable from *T. rufulus*.

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[1] Proc. U. S. Nat. Mus., VII, p. 173.

During my entire trip I was everywhere received with so much courtesy that I find it difficult to properly express my appreciation of the assistance which was always graciously rendered me. To the following gentlemen I am especially indebted for favors which contributed materially to whatever success has attended my efforts: Captain Byers and Chief Engineer Walker of the Trinidad Line of Steamers; Harry Vincent, Esq., Trinidad's Commissioner to the World's Fair; William Cunningham, Esq., formerly of Port-of-Spain; H. Caracciolo, Esq., President of the Trinidad Field Naturalists' Club; and Henry C. Warner, Esq., Warden of Savanna Grande.

I.—GENERAL REMARKS ON TRINIDAD BIRD-LIFE.

The following remarks are based principally on my experience at the rest-house, where a residence of two months permitted me to become fairly familiar with the birds of a limited area, but nevertheless an area which seemed to present many phases of tropical bird-life.

Number of Species.—During my stay at the rest-house I identified 115 species of resident land-birds. In addition to this number I observed or heard at least six species which I did not secure. No additions were made to my list after the first month, and I think the number given fairly represents the avifauna of the locality during March and April. With one or two exceptions these birds were found within half-a-mile of the rest-house, and the richness of the avifauna will therefore be readily seen.

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[1] A preliminary description was published in 'The Auk,' 1893, p. 342.

The average number of birds seen daily was fifty-six. If, however, I visited ground of varying character the number of species observed in a single day might reach seventy. The 115 species recorded may be classed according to their relative numbers as follows: Abundant, 14; common, 45; tolerably common, 26; rare, 30. In considering these figures my unfamiliarity with the avifauna and the difficulty with which some birds were observed must of course be taken into account.

While the presence of birds in large numbers was dependent upon the supply of food, bird-life was nevertheless very generally distributed, and there was comparatively little variation in the number of birds seen daily.

Migration.—Using the word in its restricted sense, the migratory birds which regularly visit Trinidad are too few in number to make any impression upon the character of the land-bird avifauna, which, as a whole, is apparently much the same throughout the year. There are a few species, notably *Milvulus tyrannus*, which come from the mainland in the summer, or wet season, and return to the continent for the winter, or dry season, but as a rule the land-birds of the island are resident.

Although my observations covered so brief a period they gave me some idea of the fluctuations in tropical bird-life due to food-supply.

It is a well-known fact that a large class of tropical birds consists of fruit and flower feeding species, whose presence is dependent upon the flowering of certain trees or the ripening of their favorite fruits.

On my arrival at the rest-house, March 1, the *bois immortel* trees (*Erythrina coccinea*) were in full bloom. Among the birds which were attracted to their blossoms, Hummingbirds and Blue Honey-creepers (*Arbelorhina cyanea* and *A. cærulea*) were especially abundant. March 15 the blossoms had almost disappeared, and from that date until my departure some of the Hummingbirds previously so common were not observed again, while the Honey-creepers, which had been as abundant as swarming bees, were rarely seen. Doubtless they were attracted to some fresh food which took them beyond the boundaries of my field of observation. At Monos Island I was told that some species, Pigeons among the number, are drawn from the mainland to Trinidad by the ripening of certain fruits. Instances of this kind, however, probably occur only among the roving species possessed of extended powers of flight.

With the exception of shore-birds few North American migrants visit Trinidad. The island is beyond their line of flight. Four species of Ducks, one of Rail, and twenty-nine species of Snipes and Plovers, show that the island is a winter resort for some of our water-birds, but of land-birds only the following have been recorded : *Coccyzus americanus*, *Coccyzus erythrophthalmus*, *Ceryle alcyon*, *Spiza americana*, *Piranga rubra*, *Chelidon erythrogaster*, *Protonotaria citrea*, *Dendroica æstiva*, *Seiurus noveboracensis* and *Setophaga ruticilla*. Of these *Spiza americana* and *Protonotaria citrea* have not been recorded from the Lesser Antilles, and the occurrence of the former indicates the probability of their having reached Trinidad from Venezuela.

The remaining seven species are more or less common in the Lesser Antilles, and their presence in Trinidad is in support of Prof. Julien's[1] observations on the arrival of birds in the island of Sombrero from the northwest.

Indeed it seems not improbable that, as Prof. Julien has suggested, some of these birds may have reached Sombrero by a direct flight from the Bermudas, a distance of over 800 miles.

Acccording to Reid, the land-birds which visit the Bermudas with more or less regularity are *Ceryle alcyon*, *Coccyzus americanus*, *Chordeiles virginianus*, *Dolichonyx oryzivorus* and *Seiurus noveboracensis*. The North American land-birds recorded by Prof. Julien from Sombrero are : *Setophaga ruticilla*, *Chelidon erythrogaster*, *Dolichonyx oryzivorus* and *Coccyzus americanus*. Passing southward to Grenada, the last of the Antillean chain, we find the following North American land-birds recorded from that island by Wells :[2] *Ceryle alcyon*, *Dolichonyx oryzivorus*, *Chelidon*

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[1] *Cf.* Ann. Lyc. Nat. Hist. New York, VIII, 1864, p. 93.

[2] Proc. U. S. Nat. Museum, IX, 1886, p. 609.

erythrogaster, *Setophaga ruticilla* and *Seiurus noveboracensis*. Thus the five North American land-birds which occur more or less regularly in the Bermudas represent 50% of those which have been recorded from Sombrero, 60% of those known from Grenada, and three of the five have been taken in Trinidad. This rather remarkable agreement in numbers and species of migrants visiting these islands would seem to imply a direct flight from the Bermudas to Sombrero, and thence southward through the islands. It is true that all the regular Bermudan migrants, except *Dolichonyx*, have been found in Porto Rico, and while many North American species winter in that island, others no doubt pass southward through the Lesser Antilles. Nevertheless the observations of Prof. Julien, and the facts just cited are strong evidence in support of a regular migration of birds from the Bermudas to the northern Lesser Antilles, the longest flight, as far as I know, made by migrating birds.

Call-Notes and Songs.—Probably the most fascinating part of one's experience in a new avifauna consists in learning the notes of species which he has not previously observed. This pleasure is of course heightened as increasing familiarity with living birds gives additional data for comparison.

After returning from my first outing in Trinidad forests my mind was so confused by the great variety of strange calls, cries, and whistles that I had clear impressions of the notes of but few birds. Except for the advantage of knowing most of the birds as 'skins,' it was very much like beginning the study of field ornithology over again. After I had learned to recognize birds by their notes I was struck by three things, the first of which has been commented on by most writers on tropical birds; that is, the comparative absence of singing birds. Of the 115 land-birds seen at the rest-house only three had songs which were sustained more than a few seconds. They are a Thrush (*Merula gymnophthalma*), a small Tanager (*Euphonia violacea*), and a Finch (*Sporophila grisea*). To this number may be added a number of species which would come under the general head of song-birds, though their vocal efforts are restricted to a few notes, which are not sung continuously. The leaders among these are *Troglodytes* *rufulus*, *Thryothorus rutilus*, *Cyclorhis flavipectus*, *Geothlypis æquinoctialis*, *Basileuterus vermivorus olivascens* and *Vireo chivi agilis*. There are others which, strictly speaking, should be ranked as song-birds, but their notes are too insignificant to make them prominent. But the class of birds whose notes give character to the avifauna are not true song-birds, though species are included which possess more vocal ability than many birds so classed. These birds, however, do not sing, but squeak, squawk, chuckle, whistle, chatter, quack, scream, or coo, in fact make all manner of sounds musical and unmusical. The principle species in this class are the Tanagers (*Ramphocelus* and *Tanagra*), the Cassiques (*Ostinops* and *Cassicus*), *Icterus*, *Pitangus*, *Tyrannus*, *Formicarius*, *Myrmeciza*, *Crotophaga*, *Ramphastos*, Parrots, Trogons, Owls, Doves and Tinamous.

The second thing about the notes of Trinidad birds which impressed me was a generic resemblance in song. For example, any one familiar with the song of the House Wren (*Troglodytes aëdon*) would at once recognize the Trinidad House Wren by its song. In a similar manner the notes of *Vireo chivi agilis*, *Icterus*, *Molothrus*, *Tyrannus*, *Trogon*, *Amazona*, *Chætura*, *Glaucidium*, and the Doves, at once betrayed the generic relationship of the singer. Several of these instances are particularly interesting, giving, as they do, evidence of a common origin, and also of the stability of characteristic calls and songs.

But on the other hand I was struck by the remarkable resemblance among the notes of birds very distantly related. Thus some of the notes of *Synallaxis albescens*, *Thamnophilus doliatus*, *Dendrornis*, and *Trogon meridionalis*, were so like some of those of *Sayornis phœbe*, *Corvus americanus* and *Colaptes auratus*, respectively, that were either bird heard in the habitat of the other its identity would not be suspected.

Nesting.—March 1, when I reached the rest-house, many birds were nesting and young birds were on the wing. May 1, when I left the rest-house, the nesting season had apparently not reached its height.

In the tropics the nesting season is not necessarily governed, as it is in the north, by climatic conditions and the food-supply.

One month is much like another, and a bird may nest in June or December as far as external conditions are concerned. It is worthy of note, therefore, that although a tropical nesting season is less sharply defined than a boreal one, it is nevertheless a nesting season of periodic and regular occurrence.

A comparison of the nests of northern with those of tropical birds shows how much more complex in form are the latter. The eggs and young of tropical birds are exposed to so many dangers which do not threaten those of northern species that special types of nest structure appear to have been evolved as a means of protection. Tree-snakes, lizards, opossums, monkeys, ants, large spiders, and nest-robbing birds are probably the most destructive foes of nesting birds, and the heavy rains of the wet season may destroy the homes of some species.

It is doubtless these causes which have been effective in producing such architectural marvels as the nests of *Ostinops*, *Rhynchocyclus*, *Synallaxis*, and, to go out of Trinidad, the many extraordinary nests of birds throughout the tropics.

I was impressed by the fact that some simple nests, so to speak, were covered and had entrances at the side. For example, *Pitangus* and *Cœreba.* Nests constructed in this way would effectually shed water and thus be habitable during the wet season.

We know as yet comparatively little concerning the nesting habits of tropical birds, and, aside from other reasons, the density of the vegetation, as Dr. Léotaud remarked, often successfully defies the best attempts to discover the treasures the birds have confided to its keeping.

The Colors of Tropical Birds.—In Trinidad I saw alive for the first time many species of birds which had long been familiar to me as 'specimens.' Several of these birds interested me greatly by the display of markings, which in the dried 'skin' are entirely concealed. Thus the white lesser wing-coverts of *Tanagra melanoleucus* were conspicuous when the bird was flying, while the habit of nervously flitting its wings made a similar marking in *Oryzoborus* easily visible. Again the white nuchal collar in *Florisuga* was frequently displayed while the bird was in flight, and my observations on the mating habits of *Thamnophilus major* show, I think, that the white dorsal patch is intentionally displayed.

The relation of color to environment is so complex a subject, and any attempt at its explanation involves so exact a knowledge of the governing causes, that my own brief experience was sufficient only to show me how necessary field experience is to the solution of problems of this kind. Only a close study of the living bird *in a part of its habitat which has not been altered by man's agency* will result in the accumulation of data from which we may rightly attempt to draw conclusions. It seems to me of the utmost importance that a species should be found in what is absolutely a state of nature if we are to appreciate the harmony which exists between it and its environment. In clearing the forests, planting crops, etc., man has brought about a new condition of things to which many species have succumbed, while others apparently have adapted themselves to their changed surroundings. But what the result will be it is too soon for us to say. In the meantime we must go to primæval nature if we are to gain a proper understanding of the life-history of any animal. The forests at the rest-house afforded me such an opportunity, and in even my short visit I was struck by the distribution of bird-life in them.

Forest birds may be placed in five classes, as follows: (1) The birds of the tree-tops. These are largely insect, fruit, or flower-eating species. Honey-creepers and Honey-suckers (*Cœreba*, *Arbelorhina*, *Dacnis* and *Chlorophanes*), Tanagers (*Ramphocelus*, *Tanagra*), Orioles, Parrots and Paroquets, and Hummingbirds, except *Phaëthornis*, *Pygmornis*, and *Glaucis* are characteristic species of this class. (2) The birds of the trees. These are fruit and insect-eating species, which as a rule inhabit the body of the trees rather than their outer branches. They are less active and more sedentary than the birds of the first group. Representative species are *Cyclorhis*, *Saltator*, *Vireo*, *Trogon*, *Myrmotherula*, *Dysithamnus*, and several of the green Flycatchers. (3) The birds of the tree-trunks. These of course are scansorial birds. Examples are *Dendrocincla*, *Dendrornis*, *Picolaptes*, *Dendrobates* and *Chloronerpes*. (4) The birds of the undergrowth. These are generally found about the borders of the forest where the added light permits a denser low growth. Wrens, Thrushes, *Ramphocænus*, *Platyrhynchus*, *Thamnophilus*, *Glaucis*, *Phaëthornis*, and *Pygmornis* may be included here. (5) The birds of the ground. This class contains such purely terrestrial species as *Aramides*, *Heterocnemis*, *Myrmeciza*, *Nyctidromus*, *Engytila*, and Tinamous. Now there is a remarkable agreement in color among the birds of these five groups *inter se*. The first class is composed of the most brilliantly colored birds of the tropics. To their misleading abundance, in what may be termed popular collections of birds, we owe the general belief that tropical birds are generally of bright plumage, whereas the truth is they are greatly exceeded in numbers by plainly colored species. The second class might be called green birds, though they are not all of this color. The remaining classes are, generally speaking, brown birds. Some are black, or black and white, but they are all inconspicuously colored. A comparison of the members of the first group with those of the fourth or fifth, emphasizes the great difference in color which exists between them. In no birds is it better shown than in the Hummers. Those of the first group are famous for the brilliancy of their plumage, while those of the fourth are dull and obscurely colored.

An attempt to explain this distribution of colors opens a wide field for speculation, upon which I confess I hesitate to venture. I believe, however, that the first object of color is concealment. That is, harmony in color between a bird and its immediate surroundings which will result not alone in concealing it from its enemies, but by rendering it less conspicuous will enable it to secure its food.

The colors of the birds I have mentioned are of this nature. The gayly plumaged birds of the first class are brought into contrast with the bright fruit or flowers; those of the second class are generally green like the foliage about them; those of the remaining three classes are for the most part brown like their background of bark or dead leaves.

While it may not be questioned that in their distribution these birds do harmonize in color with their surroundings, it might be suggested that their colors were in some way dependent on their exposure to light. But a consideration of the dull colors of plain-inhabiting species, which, like the brightly-colored tree-top birds, are constantly exposed to the direct rays of the sun, shows apparently that light is here not an active agent.

I do not speak particularly of the birds of the clearings or cacao groves near the rest-house, for the conditions in both these places were not natural, though even here it was evident that birds sought what were approximately their true haunts. For instance, the tops of the blossoming *bois immortel* trees in the cacao groves would be thronged with many species of the first class. Lower down the green Flycatchers lived, while although the brown Hummers (*Phaëthornis*, *Pygmornis*, and *Glaucis*) were frequently seen probing banana blossoms beneath the *bois immortel* trees, I never once saw one feeding from their brilliant blossoms. Where the grass had been permitted to grow in the groves, Finches or brown Synallaxes might be found. Thus, as in the forest, there was a protective resemblance between a bird and its surroundings.

Beyond this claim for the primary importance of protective coloration I do not for the present care to go. The intensity of the struggle for existence reaches its maximum in the tropics. Birds are there beset by so many dangers that survival means perfect harmony with the environment.

II.—A LIST OF THE BIRDS OF THE ISLAND OF TRINIDAD.

While I believe that the most natural order in which to arrange lists of species of any class of animals is to begin with the lowest forms and end with the highest, most writers on South American birds have followed exactly the opposite plan, and any attempt to change would now result in so much confusion that I have decided to follow the system of previous writers, even though I disapprove of it.

The native English and Creole names given in the present paper have been furnished me by Thomas W. Carr, Esq., of Port-of-Spain. Mr. Carr has for several years been compiling a list of the popular names of Trinidad birds, and has very generously placed a copy of it at my disposal.

The French names are taken from Léotaud's work. The references to 'Léotaud' and 'Taylor' are to the respective works of these authors on Trinidad birds already cited (*antea*, pp. 9, 10). The notes given refer only to my own observations, and the absence of annotations implies that the species was not met with by me.

Order PASSERES.—Perching Birds.

Family TURDIDÆ.—THRUSHES.

1. **Merula flavipes** (*Vieill.*).—YELLOW-FOOTED THRUSH. GRIVE À PATTE JAUNE.

Turdus flavipes TAYLOR, p. 80; LÉOTAUD, p. 199.

2. **Merula phæopygus** (*Cab.*).—WHITE-THROATED THRUSH. GRIVE À CRAVATTE.

Turdus phæopigus LÉOTAUD, p. 197.

3. **Merula xanthoscelus** (*Jard.*).—BLACK-BIRD. GRIVE NOIRE.

Turdus xanthoscelus LÉOTAUD, p. 201.

4. **Merula fumigata** (*Licht.*).—CACAO THRUSH. GRIVE DES CACAOS.

Turdus fumigatus TAYLOR, p. 80.
Turdus casius LÉOTAUD, p. 204.

Not common.

5. **Merula gymnophthalma** (*Cab.*).—BARE-CHEEKED THRUSH. GRIVE À PAUPIÈRES JAUNES.

Turdus gymnophthalmus TAYLOR, p. 80.
Turdus nudigenis LÉOTAUD, p. 201.

Common near the borders of the forests and in partial clearings. They are shy, suspicious birds, and some caution is necessary in approaching them. In general appearance they are typically Thrush-like, and their manner of flitting their tail on alighting is exactly like that of a Robin (*Merula migratoria*). Their ordinary call-note is a low *chût* quite unlike the call of any Thrush with whose notes I am familiar.

They began to sing on April 6, and in a few days were in full song. The song is so like that of a Robin that if it was heard in the habitat of that species it would pass as a slightly aberrant Robin's song. It is not quite so loud as the song of the Robin, is lacking in variety, and is sung less continously, but the character is the same.

Family TROGLODYTDÆ.—WRENS.

6. Troglodytes rufulus *Cab.*—GOD-BIRD. ROSSIGNOL.

LÉOTAUD, p. 170.
Troglodytes tobagensis LAWR. Auk, V, 1888, p. 403.

Both in song and habits this bird resembles our House Wren (*Troglodytes aëdon*). A pair was always to be found near every cabin, and I rarely saw it far from the vicinity of houses. In Port-of-Spain it is not uncommon in the busiest part of the city.

My specimens represent both the gray and brown phases of color. In the former the underparts are whiter, while in the latter they are more or less washed with buffy. In one specimen the under tail-coverts are without bars.

Comparison with the type of *T. tobagensis* shows it to be inseparable from this species.

7. Thryothorus rutilus *Vieill.*—BUSH WREN. ROSSIGNOL DES HALLIERS.

TAYLOR, p. 81.
Troglodytes rutilus LÉOTAUD, p. 173.

This is a not uncommon species, but it inhabits the denser undergrowth, and is much more frequently heard than seen. Its song is a loud, musical whistle, delivered with much energy and rapidity.

One of my examples agrees closely with the Panama specimens, and others are so near that there is apparently little doubt that the form from that locality should stand as *Thryothorus rutilus hyperythrus*.

Family MNIOTILTIDÆ.—Wood-Warblers.

8. **Protonotaria citrea** (*Bodd.*).—Prothonotary Warbler. Fauvette à tête jaune.

Mniotilta citrea Léotaud, p. 179.

There is no specimen of this bird in Léotaud's collection.

9. **Compsothlypis pitiayumi** (*Vieill.*).—Golden Sucrier. Sucrier doré.

Mniotilta venusta Léotaud, p. 181.

A rare bird at the rest-house, where it was observed only once, but on Monos Island it was very common.

10. **Dendroica æstiva** (*Gm.*).—Canary. Figuier.

Taylor, p. 81.
Mniotilta petechia Léotaud, p. 176.

About a dozen birds of this species were observed near the rest-house, and several were taken.

11. **Seiurus noveboracensis** (*Gm.*).—Water Thrush. Batte-queue.

Enicocichla noveboracensis Léotaud, p. 175.

Observed on half-a-dozen occasions on the banks of the forest brooks. Several specimens were taken.

12. **Geothlypis æquinoctialis** (*Gm.*).—Manicou.

Taylor, p. 81.
Trichas velatus Léotaud, p. 183.

Not common. I observed it at La Brea, and there were a few pairs at the rest-house. Its song is a low, softly modulated warble of about six double notes, quite unlike the song of *G. trichas*, which species, however, it resembles in habits.

13. **Setophaga ruticilla** (*L.*).—Redstart. Officier.

Taylor, p. 81; Léotaud, p. 248.

14. **Basileuterus vermivorus olivascens** *Chapm.*—Fauvette des halliers.

Trichas bivittatus Léotaud, p. 184.
Basileuterus vermivorus olivascens Chapm. Auk, X, 1893, p. 343 (preliminary descr.).

Chars. subsp.—Similar to *Basileuterus vermivorus* (Vieill.), but the bill averages larger, and the upper parts are constantly grayer.

Description of Type (No. 58, 974, Am. Mus. Nat. Hist., adult male, Princestown, Trinidad, March 1, 1893; Frank M. Chapman).—Back grayish olive green, exposed surface of wings and tail more brownish, centre of crown reddish brown, the feathers tipped with grayish and bordered by black lines reaching to the neck, which in turn is margined by a narrow, whitish line passing from the base of the bill over the eye; a dusky line through the eye; cheeks and ear-coverts grayish; underparts bright yellow, sides greenish; legs flesh-color; bill brownish black, lighter below. Sexes alike.

Mr. Sharpe (Cat. Bds. B. M., X, p. 393) has called attention to the differences which distinguish the Trinidad bird, and comparison of six specimens from the island with an equal number from the mainland shows the insular form to be well worthy of recognition as a race.

This bird lives in the thickets of second growth or denser undergrowth, but is not common anywhere. Its call-note is a sharp *peek*, while its song is a Dendroica-like *wee-chee-ee-ee*.

Family CŒREBIDÆ.—HONEY CREEPERS.

15. **Cœreba luteola** *Cab.*—SUCRIER.

Certhiola luteola TAYLOR, p. 81; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Certhiola flaveola LÉOTAUD, p. 126.

This was the commonest species observed by me in Trinidad. It is quite generally distributed, and always to be found near blossoming trees, the *bois immortel* proving especially attractive. They are active little birds, in no sense 'Creepers,' but suggesting rather a *Dendroica* in their movements. Their song is an unmusical effort which may be expressed by the syllables *pita, pita, pita, ker-chèr, ker-chèr*.

The nest is a rather bulky affair—of dried grasses and strips of banana bark, having the entrance on the side. It is placed, as a rule, in a thickly-leaved tree, preferably an orange tree, not more than ten feet from the ground. Young just from the nest were seen March 13. A female seen April 6 was gathering nesting material, and another seen April 18 was pulling an old nest to pieces and using the material to build a new one.

16. **Arbelorhina cærulea** (*L.*).—GREEN-LEGGED GRAMPO. GRIMPEREAU À PATTES SOUFRE.

Cæreba cærulea TAYLOR, p. 81; LÉOTAUD, p. 120.

This bird, like *A. cyanea*, was abundant in the blooming *bois immortel*, on the blossoms of which it was feeding. But from March 16, when the trees were practically out of bloom, until my departure, I saw only one bird.

17. **Arbelorhina cyanea** (*L.*).— RED-LEGGED GRAMPO. GRIMPEREAU À PATTES ROSES.

Cœreba cyanea TAYLOR, p. 81 ; LÉOTAUD, p. 118.

Early in March, when the *bois immortel* was blooming, this species was exceedingly abundant, feeding on the blossoms of these trees. By March 16th the trees had ceased blooming, and from that date until my departure this species was observed only four times.

18. **Chlorophanes spiza** (*L.*).— BLACK-HEADED GREEN HONEY SUCKER. VERT-VERT À TÊTE NOIRE.

Chlorophanes atricapilla TAYLOR, p. 81.
Dacnis spiza LÉOTAUD, p. 122.

Observed on only three occasions.

19. **Dacnis cayana** (*L.*).—VERDIGREE. VERT DE GRIS.

TAYLOR, p. 81 ; LÉOTAUD, p. 124.

Observed on only two occasions.

20. **Dacnis plumbea** (*Lath.*).—SUCRIER DES MANGLES.

Mniotilta bicolor LÉOTAUD, p. 180.

Found only on the banks of the Caroni River, where it was apparently common. Its song is a pleasant, tinkling warble.

Family VIREONIDÆ.—VIREOS.

21. **Cyclorhis flavipectus** *Scl.*—PIE-GRIÈCHE.

Cyclorhis flavipectus TAYLOR, p. 81 ; LÉOTAUD, p. 203.
Cyclorhis flavipectus trinitatis ALLEN, Bull. Am. Mus. Nat. Hist. II, 1889, p. 131.

A very common and generally distributed species, frequenting the trees in both the forest and partial clearings. It is a most unwearying songster, and its notes can be heard from early morning until late in the afternoon. Its song is a loud and musical whistle, consisting of seven notes delivered with much energy. If one answered the caller it would change the order of its notes until they became a refrain of the ordinary call. At times two birds would respond to each other in this way, continuing the performance for many minutes. Their notes were in a measure suggestive of those of *Vireo noveboracensis*.

The Trinidad bird has been described by Dr. Allen as *Cyclorhis flavipectus trinitatis* (l. c.), but as Dr. Sclater's type of *flavipectus* came from Trinidad (*cf.* orig. descr., P. Z. S., 1858, p. 448, and Cat. Bds. B. M., VIII, p. 320) the name *trinitatis* becomes a pure synonym of that species.

Specimens from Venezuela and Colombia, to which Dr. Allen restricted the name *flavipectus*, seem to me to be inseparable from the Costa Rican *subflavescens*.

22. **Vireo chivi agilis** (*Licht.*).—Petit Siffleur à tête grise.

Vireo olivaceus Léotaud, p. 250.

Common. Its song closely resembles that of *Vireo olivaceus*, but is not so loud, and is delivered more slowly.

Trinidad and Tobago evidently form the northern limit of the range of this species, while *V. calidris* apparently does not nest south of Grenada.

23. **Vireo calidris** (*L.*).—Grand Siffleur à tête grise.

Vireo altiloquus Léotaud, p. 250.

24. **Hylophilus aurantiifrons** *Lawr.*—Petit Gobe-mouche.

Hylophilus insularis Léotaud, p. 186.

Common in the forests and partial clearings where they frequent the trees. Several are generally seen together flitting about actively and uttering a *cack* note like that of the Ruby-crowned Kinglet. Their song is a warble, composed of six notes and suggesting a part of the song of *V. olivaceus*.

On comparison with the type of *H. aurantiifrons*, my specimens show, as Dr. Gadow has suggested, that the Trinidad bird is not separable from that species.

Family HIRUNDINIDÆ.—SWALLOWS.

25. **Progne chalybea** (*Gm.*).— MARTIN. HIRONDELLE NOIRE.

Progne purpurea LÉOTAUD, p. 92.

Observed only at the mouth of the Cipero River, at Moruga, and in the Monos Boca. In the two last-named localities it was common and was nesting in crevices in the rocky cliffs.

26. **Atticora cyanoleuca** (*Vieill.*).—SWALLOW. HIRONDELLE À VENTRE BLANC.

Hirundo cyanoleuca LÉOTAUD, p. 90.

27. **Tachycineta albiventris** (*Bodd.*).—SWALLOW. HIRONDELLE À DOS VERT.

Hirundo albiventer LÉOTAUD, p. 91.

Observed only at the mouth of the Cipero, where it was not uncommon.

28. **Chelidon erythrogaster** (*Bodd.*).—BARN SWALLOW. HIRONDELLE À VENTRE ROUX.

Hirundo rufa LÉOTAUD, p. 88.

29. **Stelgidopteryx uropygialis** (*Lawr.*). — SWALLOW. HIRONDELLE À VENTRE JAUNE.

Cotyle uropygialis LÉOTAUD, p. 94.

Common on the coast and occasionally seen at the rest-house.

Family TANAGRIDÆ.—TANAGERS.

30. **Procnias viridis** *Ill.*— BLUE MANTLE. COTTINGA BLEU.

Tersa ventralis LÉOTAUD, p. 257.

31. **Euphonia violacea** (*L.*).—LOUIS D'OR SIMPLE.

TAYLOR, p. 82 ; LÉOTAUD, p. 306.

Not uncommon. This bird easily takes first place among the limited number of Trinidad song-birds. Its song is a sweet, varied warble, which sometimes is continued for a minute or more.

Like the song of *Sporophila grisea*, however, it lacks in volume and can be heard only a short distance.

32. **Euphonia trinitatis** *Strickl.*—CRAVAT. LOUIS D'OR À CRAVATTE.

Euphonia chlorotica LÉOTAUD, p. 308.

33. **Euphonia nigricollis** (*Vieill.*).—LOUIS D'OR À TÊTE BLEU.

TAYLOR, p. 81.
Euphonia aureata LÉOTAUD, p. 310.

34. **Calliste desmaresti** *Gray.*—WORTHLESS. VERT-VERT À TÊTE CACO.

TAYLOR, p. 82; LÉOTAUD, p. 302.

35. **Calliste flaviventris vieilloti** (*Scl.*).—VARIEGATED TANAGER. DIABLE ENRHUMÉ.

Calliste vieillotii TAYLOR, p. 82; LÉOTAUD, p. 303.

Occasionally seen in pairs, threes or fours, but by no means common. They are restless birds, and pass little time in one place unless attracted by their food, which seemed to consist largely of berries. I did not hear them utter a note.

36. **Calliste guttata** (*Cab.*).—TIGER TANAGRA. ARRIVANT.
TAYLOR, p. 82; LÉOTAUD, p. 305.

37. **Tanagra cana sclateri** (*Berl.*).—BLUE-BIRD. OISEAU BLEU.

Tanagra cana TAYLOR, p. 82.
Tanagra glauca LÉOTAUD, p. 293.
Tanagra sclateri RIDGW. Proc. U. S. N. M. VII, 1884, p. 183.

A very common species. They are very active, restless birds, almost constantly on the move. They seem to prefer trees having little foliage, and alight on the bare branches, pausing only for a moment and then continuing their apparently objectless flight. Their call-note, which they utter when about to take wing, is an unmusical, long-drawn *s-e-e-e-p*, and their song is made up of the same unattractive sound.

On March 15 I saw a nestling of this species following two adults, probably its parents.

38. Tanagra palmarum melanoptera (*Hartl.*).—PALMISTE.

Tanagra melanoptera TAYLOR, p. 82.
Tanagra olivascens LÉOTAUD, p. 295.
Tanagra palmarum RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.

Very common. Pairs and small groups of three to six individuals could be seen at almost any time during the day. They are much on the wing, and resemble *Tanagra c. sclateri* in their nervous restlessness.

They were particularly common in the *bois immortel*, apparently feeding on the blossoms. As a rule they alight on the tops of leafless trees, where they hop actively from limb to limb, flitting both wings and tail, and occasionally breaking into a chorus of song. Their notes resemble those of *sclateri*, and consist of a sharp, metallic call-note which may be written *sweer*, while their song is a rambling kind of weak, squeaky warble.

39. Tanagra cyanocephala subcinerea (*Scl.*).—BLUE-HEADED TANAGRA. GROSBEC À TÊTE BLEU.

Tanagra subcinerea LÉOTAUD, p. 296.

40. Ramphocelus jacapa magnirostris (*Lafr.*).—SILVER-BEAK. BEC D'ARGENT.

Ramphocœlus magnirostris TAYLOR, p. 82.
Ramphopis jacapa LÉOTAUD, p. 288.

Very common. Generally four or five were seen together at the borders of second growth or in the *bois immortel*. Like the other Tanagers, they are active, restless birds. The only note I heard is a hoarse *cheep*, very much like the call-note of a Song Sparrow (*Melospiza fasciata*). A nestling attended by the parents was seen on March 13.

41. Piranga rubra (*Linn.*).—SUMMER TANAGER. COTTINGA ROSE.

Pyranga æstiva LÉOTAUD, p. 290.

A specimen in the Léotaud Collection.

42. Piranga hæmalea *S. & G.*—RUFOUS TANAGER. CARDINAL À GROS-BEC.

Pyranga hepatica LÉOTAUD, p. 291.

One specimen, apparently of this species, is in the Léotaud Collection.

43. Phœnicothraupis rubra (*Vieill.*).—CARDINAL.

TAYLOR, p. 82.
Tachyphonus ruber LÉOTAUD, p. 297.

Not uncommon. Unlike the other Tanagers, it was never seen in the clearings, but was found only in the forests, where it lives near the ground. In the subdued light of these localities the male appears to be brown in color. Their call is a sharp, pebbly, clicking note, which sometimes becomes a long, rolling call. They are shy birds, and can be approached only by using caution.

44. Lanio lawrencei (*Scl.*).

Tachyphonus atricapillus LAWR. Proc. Acad. Nat. Sci. Phila. 1868, p. 360.
Lanio lawrencei SCL. Ibis, 1885, p. 272, Pl. vi, Fig. 2.

The type of this bird, which Mr. Lawrence definitely states was killed by Mr. Alexander in Trinidad, still remains unique. I follow Dr. Sclater in placing it in *Lanio*, though, as far as one can judge from this single immature specimen, it has little affinity in color with the members of that genus.

45. Tachyphonus luctuosus *Lafr.* — LITTLE PARSON. PETIT PÈRE NOIR.

Tachyphonus albispecularis LÉOTAUD, p. 300.

46. Tachyphonus rufus (*Bodd.*).—PARSON. PÈRE NOIR.

Tachyphonus melaleucus TAYLOR, p. 82; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Tachyphonus beauperthuyi LÉOTAUD, p. 299.

Very common. They were generally seen in pairs which frequented the partial clearings and cacao groves. While perching they maintain a constant nervous flitting of the wings, an action which in the male shows the white lining of the wings conspicuously. The same mark is seen when the bird is flying.

47. Chlorospingus leotaudi *Chapm.*

Chlorospingus leotaudi CHAPM. Auk, X, 1893, p. 343.

Char. sp.—Apparently most like *C. chrysogaster* Tacz. in coloration, but much smaller, and with a larger bill.

Description of Type (Coll. Am. Mus. No. 59,051, female, Princestown, Trinidad, March 28, 1893; Frank M. Chapman).—Crown and nape cinereous, washed with olive green; back bright olive green; wings and tail fuscous, the exposed margins of the feathers olive green; auriculars cinereous; throat and upper part of the breast pale grayish white, rest of the underparts bright yellow; bill horn-black; feet brownish black. Wing, 2.40; tail, 2.25; exposed culmen, .50; height of bill at anterior margin of nostril, .22 in.

I have not seen a specimen of *C. chrysogaster*, described by Taczanowski from Peru. While evidently near *C. leotaudi*, it belongs in the small-billed section of the genus (subgenus *Hemispingus*), and Taczanowski remarks that it is one of the smallest-billed species of the genus. *C. leotaudi*, on the contrary, belongs in the large-billed section, and has a bill as large as any species with which I am familiar. Compared with *C. rubrirostris*, the bill is thicker, and horn-color instead of red; the cinereous of the head does not extend as far down the nape, and the grayish white does not reach so far down the breast. I have named this apparently distinct species in honor of the late Dr. Léotaud, in recognition of his devotion to the study of ornithology.

The specimen described was secured in the forest, and was the only one observed.

48. **Saltator albicollis** *Vieill.*—Gros-bec tacheté.

Saltator striatipectus Léotaud, p. 286.

This species was observed only on Monos Island, where it was common.

49. **Saltator olivascens** *Cab.*—Gros-bec.

Taylor, p. 83.
Saltator icterophrys Léotaud, p. 285.

A common species at the borders of the forest, where it frequented the tree-tops. Its song is unmusical, but possessed of decided character, and it is rather singular that it has not served as the basis for a popular name. It may be almost exactly expressed by the syllables *pitt-qùit-you*, *sit-qùat-you*, followed by some indeterminate warbling.

Family FRINGILLIDÆ.— FINCHES, SPARROWS, ETC.

50. Spinus cucullata (*Swains.*).—COLORADO.

Two individuals were seen on Monos feeding on the fruit of a large cactus. They are said to be common there at times.

This species is given by neither Taylor nor Léotaud, but 'Trinidad' specimens are included in the Catalogue of the Birds of the British Museum, Volume XII.

51. Spiza americana (*Gm.*).—DICKCISSEL. MOINEAU.

Euspiza americana LÉOTAUD, p. 314.

There are three specimens of this bird in the Léotaud Collection.

52. Volatinia jacarini splendens (*Bp.*).—BLACK FINCH. PETIT ÇIÇI-ZÈBE NOIR.

Volatinia jacarina TAYLOR, p. 83.
Tiaris jacarini LÉOTAUD, p. 312.

Common in flocks in the grasses of uncultivated cacao groves. The white shoulder-mark can be seen when the bird is on the wing.

While *en route* from Trinidad to Grenada a female of this species boarded our steamer. We were then about halfway between the islands. The bird was in an exhausted condition, and was caught without difficulty. We anchored about half a mile off the harbor of St. Georges, Grenada, where I have no doubt the bird went ashore, as I did not see it after leaving the island.

This instance is of interest in showing how certain South American species may have originally been introduced on islands near the mainland.

53. Sporophila grisea (*Gm.*). — GRASSBIRD. ÇIÇI-ZÈBE GRIS.

Spermophila intermedia TAYLOR, p. 83.
Spermophila cinereola LÉOTAUD, p. 319.

Common, frequenting the same localities in which *O. torridus* was found.

This was one of the few birds met with which deserves the name of songster. Its song is musical, varied and well-sustained, and reminded me of the songs of both a Mocking-bird and a Canary. If this song possessed volume the bird would take high rank as a vocalist, but unfortunately it is uttered in such a weak tone that it is not audible more than 100 feet. Furthermore, the bird does not seem to sing frequently, and its song is, therefore, apparently unknown to the natives.

54. Sporophila lineola trinitatis (*Sharpe*).—Grassbird. Çiçi-zèbe à cravatte noire.

Spermophila bouvreuoides Léotaud, p. 318.

55. Sporophila gutturalis (*Licht.*). – Grassbird. Çiçi-zèbe à ventre jaune.

Spermophila gutturalis Léotaud, p. 321.

Observed on five occasions.

56. Sporophila minuta (*L.*). — Grassbird. Çiçi-zèbe à ventre roux.

Spermophila minuta Taylor, p. 83; Léotaud, p. 322.

There was comparatively little ground near the rest-house suitable for Finches, and this species was observed on five occasions.

57. Oryzoborus torridus (*Scop.*).—Çiçi-zèbe à dos noir.

Pitylus torridus Léotaud, p. 283.

Common near the borders of low, bushy second-growth, in which, on being alarmed, it sought refuge. When perched it frequently flits its wings in a quick, nervous manner, and this action displays conspicuously their white under surface. I heard no call-note or song from this species.

58. Oryzoborus crassirostris (*Gm.*).—Grassbird. Gros Çiçi-zèbe noir.

Spermophila crassirostris Léotaud, p. 316.

Only one was secured.

Family ICTERIDÆ.—Blackbirds, Orioles, Cassiques, etc.

59. Ostinops decumanus (*Pall.*).—Cassique. Caçique huppé.

Ostinops cristatus Taylor, p. 83.
Cacicus cristatus Léotaud, p. 271.

Locally common in the forests. The life-history of this species would no doubt fill a volume. It is a bird of marked character, and its notes and habits are of more than usual interest. There were no birds resident in the immediate vicinity of the rest-house, and for this reason I had no opportunity to study the species closely. During March and April they were nesting. Their nests were generally placed at the extremity of the upper branches of forest trees. In riding from the rest-house through the forest to Moruga, a distance of twelve miles, I saw some fifteen trees bearing nests of *Ostinops*, all of which were apparently occupied. One tree held twenty-six of these long, pendulous structures, and in addition six nests of *Cassicus*. The largest nest I measured was four feet in length. In building them the birds seem to work from the inside. They enter the holes very quickly, in reality flying into them.

Henry C. Warner, Esq., the Warden of Savanna Grande, who has had many years experience in Trinidad forests, called my attention to the fact that these birds nearly always place their nests upon a tree having a smooth bark, and I noted only one exception to this apparent rule. The object of the birds in selecting trees of .this nature is presumably to find security from the attacks of tree-snakes or nest-robbing mammalia.

The notes of these birds are among the strangest I have ever heard. Many of them suggest the singular vocal performances of the Great-tailed Grackle (*Quiscalus macrourus*). They squeak, squawk, quack, chuckle and whistle in indescribable ways. The male, bending his head low and ruffling his plumage, utters a long-drawn, creaking call, which resembles the sound produced by chafing trees in a gale. Then he strikes his wings together over his back, producing a crackling sound like the snapping of branches. Other notes are as mellow as those of a cuckoo-clock. When flying their rapid wing-beats sound like the paddles of a distant side-wheel steamer striking the water.

Their favorite food consisted of the fruit of the 'agalee' or 'cupey' tree.

60. Cassicus persicus (*L.*).—CORNBIRD. MERLE À CROUPION JAUNE.

TAYLOR, p. 84; LÉOTAUD, p. 273.

This species was found in about the same numbers as *Ostinops decumanus*, which it resembles in habits. Its notes are somewhat similar in character to those of that species, but are easily distinguishable. Its nests are much smaller than those of *Ostinops*, and measure about one foot in length. Young, just from the nest, were seen March 10, but the species was still nesting late in April.

61. Icterus xanthornus (*Gm.*).—CAROUGE.

TAYLOR, p. 84; LÉOTAUD, p. 275.

Common about cacao groves and partial clearings. They are particularly fond of the blossoms of the banana, and also frequent the blooming immortel trees. Their song consists of six high flute-like notes, but they rarely sing more than two notes at a time. Their call-note is a sharp, harsh *weet, weet*. Several nests seen on Monos Island were pendulous, one foot in length, and were placed about twenty-five feet from the ground.

62. Molothrus atro-nitens (*Cab.*).—LITTLE BLACK STARE. PETIT MERLE NOIR.

Molothrus bonariensis LÉOTAUD, p. 277.

Not common. The note of the male is a bubbling twitter, sufficiently like that of *M. ater* to show at once the generic relationship of the singer.

63. Agelaius icterocephalus (*L.*).—YELLOW-HEADED CAROUGE. MERLE À TÊTE JAUNE.

Xanthosomus icterocephalus TAYLOR, p. 84.
Chrysomus icterocephalus LÉOTAUD, p. 281.

Seen only at the mouth of the Cipero.

64. Liestes guianensis (*L.*). — SOLDIER-BIRD. ROUGE-GORGE.

TAYLOR, p. 84.
Leistes americanus LÉOTAUD, p. 279.

A few were seen at the mouth of the Cipero.

65. Quiscalus lugubris *Swains.*—TRINIDAD BOAT-TAIL. MERLE À QUEUE EN BATEAU.

TAYLOR, p. 84.
Quiscalus barita LÉOTAUD, p. 268.

This bird was taken only at the mouth of the Cipero.

66. Cassidix oryzivora (*Gm.*).—BLACK CORN-BIRD. TAÏRICO.

Scaphidurus ater LÉOTAUD, p. 269.

Not uncommon in or near cornfields. The only note I heard was of a cracked, reedy character. An adult male in full breeding plumage has the feathers of the sides of the neck much lengthened, forming, when erected, a ruff an inch in length.

Family TYRANNIDÆ.—FLYCATCHERS.

67. Fluvicola pica (*Bodd.*).—WIDOW. VEUVE.

TAYLOR, p. 85; LÉOTAUD, p. 205.

Common at the mouth of the Cipero, but only a few were observed near the rest-house, where they frequented the vicinity of brooks in the forest. They seemed to be silent birds, and on no occasion did I hear them utter a note.

68. Arundinicola leucocephala (*L.*).—WHITE-HEADED WIDOW. VEUVE À TÊTE BLANCHE.

LÉOTAUD, p. 207.

Two were observed at the mouth of the Cipero.

69. Platyrhynchus mystaceus insularis *Allen.*—BROAD-BILL. GOBE-MOUCHE À BEC PLAT.

Platyrhynchus cancromus LÉOTAUD, p. 243.

A rather rare species. It frequents the denser undergrowth in the forests, where even on the brightest days a semi-gloom prevails. Its note is a sharp, unexpectedly loud *peek*.

The nature of this bird's haunts suggests that its remarkably broad bill and large mouth may assist it in catching insects, and that they are thus analogous to the large mouth and rictal bristles of the night-feeding Caprimulgidæ.

70. Mionectes olivaceus *Lawr.*—Gobe-mouche vert.

Elania striaticollis Léotaud, p. 238.

There is one specimen in the Léotaud Collection. I have compared it with the type of *M. olivaceus* Lawr.

71. Mionectes oleagineus (*Licht.*).—Gobe-mouche roussâtre.

Taylor, p. 85.
Elania oleaginea Léotaud, p. 235.

A not common species, frequenting second-growth.

72. Myiopatis semifusca (*Scl.*).

Phyllomyias semifusca Taylor, p. 86.

I found this species only on Monos Island.

73. Ornithion pusillum (*Cab.*).—Petit Tillon.

Camptostoma imberbe Taylor, p. 86.
Myiopatis pusilla Léotaud, p. 234.

Not common. It seems to be more of a gleaner, like the Vireos, than a typical Flycatcher. Its note is a musical *tee-oo*.

74. Elainea gaimardi (*d'Orb.*). — Petit Tillon à huppe blanche.

Elania fallax Léotaud, p. 236.

A common species in the forests, second-growth and cacao groves. Its call is a soft *pee-a-wee*, which might be easily mistaken for that of *Contopus virens*.

75. Elainea pagana (*Licht.*).—White-tufted Petchary. Tillon.

Taylor, p. 86.
Myiobius martinicus Léotaud, p. 224.

A very common species at the borders of the forests and in the cacao groves. It is an active bird, and with crest erect seems to be constantly on the alert. Its notes, consisting of a hoarse, scolding whistle, followed by a Phœbe-like chattering, are frequently uttered. It is by no means a typical Flycatcher, but seems to feed quite as much on fruit as on insects. A female shot on April 14 was laying.

76. **Legatus albicollis** (*Vieill.*). — Black-banded Petchary. Gobe-mouche à bandeau.

Myiobius leucophaius Léotaud, p. 227.

There is one specimen in the Léotaud Collection.

77. **Sublegatus glaber** *Scl.*

Found only on Monos Island.

78. **Myiozetetes sulphureus** (*Spix*).

One of two specimens seen at La Brea was taken.

79. **Rhynchocyclus flaviventris** (*Wied*). — Broad-bill. Gobe-mouche à dos vert.

Platyrhynchus flaviventris Léotaud, p. 247.

A common inhabitant of the forests and second-growths, where it frequents the lower trees. Its note is a loud, high *s-e-e-e-e-p.*

80. **Rhynchocyclus sulphurescens** (*Spix*). — Broad-bill. Tillon à large bec.

Platyrhynchus æquinoctialis Léotaud, p. 245.

Not uncommon in the forests.

A nest of this species, found April 17, is a remarkable structure. It is composed of leaf-stems, vegetable fibres and black rootlets woven firmly together, and was hung from near the end of a slender branch about fifteen feet from the ground. It is twelve inches in length and five in width at its widest part. The outline of one side is nearly straight, of the other convex. The curve of this side meets an imaginary perpendicular line drawn from the upper to the lower end of the nest, two inches from the lower end, and is then continued in a line parallel to the other side, but three inches from it. The lower end, therefore, forms a neck two inches in length and two in internal diameter, which constitutes the entrance to the nest, while the nest itself is placed in the convexity of the curved side. The plan of the structure is therefore similar to that seen in the nests of some Weaver-birds, but is, as far as I know, unique among the Flycatchers. Its object is obviously protection from the attacks of tree-snakes and nest-robbing opossums.

When found it was not quite completed, and both birds were present, though only one seemed to be at work. They entered the tubular mouth of the nest in full flight, but with such unerring aim that their passage caused the structure to sway but slightly.

81. **Pitangus sulphuratus** (*L.*) — QU'EST-CE-QU'IL-DIT À BEC ÉTROIT.

Pitangus rufipennis TAYLOR, p. 86.
Saurophagus sulphuratus LÉOTAUD, p. 210.

This species is one of the commonest and most generally distributed birds of Trinidad. It is a very noisy bird, and its rather harsh call, from which it receives its local name, with other rolling, chattering notes, are among the most characteristic sounds of the Trinidad bird-world. It is one of the first birds to call in the morning and the last to be heard at night. The notes of the first caller are the signal for a chorus of *Qu'est-ce-qu'il dits*, which echo from every side. Their favorite haunts are the more open growths or partial clearings, and they are always to be found in the cacao groves. Here they place their nests in the main crotch of the immortel trees at a distance of about twenty feet from the ground. The nesting season is evidently a long one. On my arrival I found completed nests, and new ones were being made at the time of my departure. They are large structures, composed of fine, dry grasses rather loosely put together, and are arched over, the entrance being on one side. Both sexes work in their construction, and I have seen one bring material to its mate who was on the nest adjusting it.

Three specimens of this bird are clearly referable to *Pitangus sulphuratus* rather than to *P. derbianus rufipennis*. The tail feathers have only a very slight margin of rufous on their outer webs, while on the primaries this color does not reach to the vane of the feather. These parts are therefore less marked with rufous than in the northern *P. derbianus*. It is obvious then that the birds cannot be referred to *P. d. rufipennis*, in which the rufous markings reach the maximum. For comparison with the Trinidad specimens I have had numerous examples of *derbianus* from Mexico, one of *P. d. rufipennis* from Bogota, and two from Santa Martha, while of *P. sulphuratus* I have one specimen from each of the following localities: El Pilar, Venezuela; the Essequibo River; and Cayenne (the type locality).

82. **Myiodynastes audax** (*Gm.*).—PIPIRI.

TAYLOR, p. 86.
Myiobius audax LÉOTAUD, p. 219.

Not uncommon in pairs in the forests. Its note is a harsh chatter.

83. **Megarhynchus pitangua** (*L.*).—QU'EST-CE-QU'IL-DIT À BEC LARGE.

TAYLOR, p. 86.
Megarhynchus chrysogaster LÉOTAUD, p. 208.

Apparently not common. Its notes are a hoarse, chattering whistle, easily recognizable from those of *Pitangus sulphuratus.*

84. **Myiobius nævius** (*Bodd.*).—YELLOW-CRESTED PETCHARY. GOBE-MOUCHE À HUPPE JAUNE.

Myiobius crysoceps LÉOTAUD, p. 222.

Not uncommon. Unlike other Flycatchers it did not frequent the forests or second-growths, but preferred brush-lots or grass-grown fields, choosing much the same locations in fact as *Synallaxis* lived in. The nature of its haunts suggests protective coloration, as the explanation of this bird's rather unusual color. The brown of its upper surface rendered it much less conspicuous than the green color of the tree-haunting Flycatchers would have done. It generally perched near the ground and remained quiet for many minutes, while uttering its simple, rolling, twittering notes

85. **Empidochanes cabanisi** (*Léotaud*). — LÉOTAUD'S PETCHARY.

Empidonax cabanisi LÉOTAUD, p. 232; SCLATER, Ibis, 1867, p. 108.
Ochthœca arenacea SCL. & SALV. P. Z. S. 1877, p. 20.
Empidochanes arenaceus SCL. Cat. Bds. Brit. Mus. XIV, 1888, p. 217.

I found this species only on Monos Island, where it is not uncommon.

An examination of Léotaud's specimens shows that his *Empidonax cabanisi* is the same as Sclater and Salvin's *Empidochanes arenaceus*, and as Léotaud's name has ten years' priority, it must replace the one subsequently given.

An *Empidochanes* from Tobago in the American Museum Collection is apparently so distinct from the Trinidad species that I have no hesitation in describing it as

86. **Empidochanes cabanisi canescens,** subsp. nov.

Char. sp.—Similar to *E. cabanisi*, but upperparts grayish brown without any tinge of greenish or yellowish; wing-coverts much paler, and underparts with scarcely a trace of yellowish.

Description of Type (Coll. Am. Mus. No. 42,760 *bis*, male, Tobago, May; Ober).—Upperparts dull grayish brown, becoming browner on the rump; tail of nearly the same color as the back, the outer webs of the feathers with slight brownish margins; wings somewhat darker than the tail, the outer edge of the first primary and of the secondaries margined with sandy grayish, the lesser and greater coverts tipped with pale isabelline; a white superciliary line; auriculars grayish; throat dirty white, breast grayish; belly white, with an almost imperceptible yellowish suffusion; flanks grayish.

For comparison with the type I have two specimens of *cabanisi* from Trinidad, and one from Venezuela. The Venezuelan specimen is practically identical with those from Trinidad.

87. **Empidonax lawrencei** *Allen.*—GREENISH-BELLIED PETCHARY. GOBE-MOUCHE À POITRINE VERDÂTRE.

ALLEN, Bull. Am. Mus. Nat. Hist. II, 1889, p. 150.
Myiobius flaviventris LÉOTAUD, p. 229.
Octhæca flaviventris LAWR. Ann. N. Y. Acad. Sci. IV, 1887, p. 60.

Not uncommon, but confined exclusively to the forests. Its note is described in my journal as *pee*, *ee-dee*, *dee-dee-dee*, given with a kind of *purling* sound.

Comparison with the unique type of *E. lawrencei* shows that my specimens should be referred to that species, the habitat of which has been before unknown. The relationships of this bird have been discussed by Dr. Allen (l. c.).

88. Contopus brachytarsus (*Scl.*).—BUFF-BELLIED PETCHARY. GOBE-MOUCHE À VENTRE JAUNÂTRE.

Contopus bogotensis TAYLOR, p. 87.
Myiobius virens LÉOTAUD, p. 226.

A common species, particularly interesting to me because of its resemblance in coloration to our *C. virens*. This resemblance is so close that Dr. Sclater remarks: "In some cases it is difficult to discriminate between this species and dwarfed or immature examples of *C. virens*." In life, however, the two species would never be confounded. *C. virens*, as is well known, is a bird which frequents higher trees of the woods, where its musical *pee-a-wee* is a characteristic sound. *C. brachytarsus*, on the other hand, was not found in the forests, but favored more open growths, cacao groves being favorite resorts. Here it perched near the ground. I rarely saw it higher than twenty feet, while its call is an unmusical, low rolling twitter.

On April 14 a pair were seen building a nest on a *bois immortel*, about twenty feet from the ground.

89. Myiarchus tuberculifer (*d'Orb. & Lafr.*).—FOOLISH PETCHARY. GOBE-MOUCHE BRUN.

Tyrannus tuberculifer D'ORB. & LAFR. Syn. Av. I, p. 43.
Myiarchus tuberculifer BERL. Ibis, 1883, p. 141.
Myiobius stolidus LÉOTAUD, p. 221.
Myiarchus tricolor PELZ. Orn. Bras. 1869, p. 182.
Myiarchus gracilirostris, *ibid.* p. 183.
Myiarchus coalei RIDGW. Proc. U. S. N. M. IX, 1886, p. 521 (type examined).
Myiarchus nigriceps SCL. Cat. Bds. Brit. Mus. XIV, 1888, p. 258 (in part).

A laying female taken April 24 was the only one observed.

Comparison shows this specimen to be the same as *Myiarchus coalei*, the type of which Mr. Ridgway has kindly loaned me. Both birds agree with a *Myiarchus* collected by Goering at Merida, Venezuela, and labeled by Count von Berlepsch "*Myiarchus tuberculifer* Lafr. & d'Orb." The same ornithologist has examined the type of *coalei*, and on the back of the label I find the pencilled identification, "=*Myiarchus tuberculifer* Lafr. & d'Orb."

Dr. Sclater (Cat. Bds. Brit. Mus., XIV, p. 259), who has examined d'Orbigny's specimens of *tuberculifer* in the Paris Museum, considers them to belong to either *Myiarchus atriceps* or *M. tricolor*.

In size, however, judging from d'Orbigny's description, they would seem to agree more closely with the latter.

Count von Berlepsch has examined Von Pelzen's types of *M. tricolor* and *M. gracilirostris*, and concludes that both are identical with *tuberculifer* of d'Orbigny, a name which he would apply to the birds with a sooty-black or brownish cap, "found in New Granada, Venezuela, [Trinidad], Guiana, Eastern Ecuador, Brazil, and Bolivia," restricting the name *nigriceps* of Sclater to the *black*-capped birds of Western Ecuador, Peru, and, I may add, Panama. Comparisons of specimens from Panama (Galbraith) and Quito with those from Venezuela and Trinidad convince me of the correctness of Count von Berlepsch's determinations.

90. **Myiarchus tyrannulus** (*Müll.*).—Black-billed Petchary. Oiseau fou.

Myiarchus ferox Taylor, p. 87.
Myiobius nigriceps Léotaud, p. 231.

Rare at the rest-house, where I observed it on only two occasions, but common on Monos. Its song is markedly different from that of *M. crinitus*.

91. **Tyrannus melancholicus satrapa** (*Licht.*).—Qu'est-ce-qu'il-dit à tête grise.

Tyrannus melancholicus Taylor, p. 87; Ridgw. Proc. U. S. N. M. VII, 1884, p. 173.
Tyrannus verticalis et *T. vociferans* Léotaud, p. 213.

Common; frequenting clearings and the more open growth. Its favorite perch was on the wires of a telegraph line which ran through the forest to Moruga, and it seemed to be the only species which regularly used them. Its call is a long, twittering, Kingbird-like roll.

Dr. Allen has recently discussed the relationships of this bird (Bull. Am. Mus. Nat. Hist., IV, 1892, p. 349).

92. **Tyrannus rostratus** *Scl.* — Qu'est-ce-qu'il-dit à ventre blanc.

Taylor, p. 87.
Tyrannus magnirostris Léotaud, p. 215.

93. **Milvulus tyrannus** (*L.*). — Swallow-tailed Flycatcher. Longue-queue.

Léotaud, p. 217.

Family PIPRIDÆ.—MANAKINS.

94. **Pipra aurocapilla** (*Licht.*).—MANAKIN À TÊTE D'OR.

TAYLOR, p. 87.
Pipra erythrocephala LÉOTAUD, p. 255.

This beautiful little bird is not uncommon, and a few were observed nearly every day. They were generally found on a low tree bearing small berries, which grew at the border of the forest just back of the rest-house. They took these berries as Trogons do, by flying at them and picking them off while on the wing. They also feed on insects, which they capture after the manner of Flycatchers. One male passed the entire day among the rafters at the rest-house. He seemed perfectly at home, and flitted from one perch to another while in pursuit of the insects gathered there.

Their note is a short, sharp twitter, not frequently uttered.

95. **Manacus manacus** (*L.*).—WASHERWOMAN. CASSE-NOISETTE.

Chiromachæris manacus TAYLOR, p. 87.
Pipra gutturalis LÉOTAUD, p. 253.

A not uncommon species. They were generally found in and at the borders of the forests, where they haunt the lower growth of bushes. They were frequently found in small companies of four to six individuals. Their chief food seemed to be small berries, which they picked while on the wing, thus resembling *Pipra aurocapilla* in feeding habits.

This bird possesses unique gifts as a musician. It produces no less than four different sounds in as many different ways. The first is vocal, and consists of a short, sharp twitter, very much like that uttered by *P. aurocapilla*. The second is presumably made by snapping the mandibles together. It can be closely imitated by quickly breaking a dry twig about the size of a lead-pencil. This is heard only when the bird is on the wing. The remaining two sounds are produced by the wing-quills. I find them described in my journal as follows: "The presence of *Manacus* is as frequently announced by the bird's whirring, buzzing flight as by a sight of the bird itself. This sound, which can be easily heard at a distance of fifty feet, seems to accompany even the shortest flight.... The whirring is apparently occasioned by the four outer attenuate primaries, as in other birds having feathers of this description. The buzzing, however, appears to be produced in an entirely different manner. The same sound can be made by simply opening and closing the wing of a freshly-killed bird. This action causes the edge of the wide, stiffened outer margins of each secondary to rub over the inner margin of the feather next to it. The result is a slight grating sound of the same character, but of course lower in tone than the buzzing produced by the bird in flying."

I afterwards held wounded birds by the bill, and in fluttering their wings they made both the whirring and the buzzing sounds.

Being thus so singularly gifted, *Manacus*, as might be expected, proved an exceedingly interesting bird. I regret that I could not determine the significance of the snapping sound, which is apparently reserved for special occasions. I heard it only when a number of the birds were together, when, evidently animated by the same motive, they hopped and flitted about in the undergrowth.

Such a scene is described in my journal under date of April 5: "An interesting bit of bird-life had for its actors four Manakins (*Manacus*). Three were in adult male plumage, the fourth was in female plumage, but, to my surprise, proved on dissection to be an immature male. The birds were in the lower bushes at the edge of the forest. They were all uttering, in an excited way, their sharp, twittering call, at the same time they were jumping back and forth from bush to bush, buzzing and whirring at every wing-stroke, and frequently, with each jump, making the sharp snapping sound. Sometimes two birds would engage in what seemed a desperate combat; at others, the activity of all would reach a maximum, and the result was the strangest chorus of bird 'music' I have ever heard."

Family COTINGIDÆ.—Cotingas.

96. Tityra cayana (*L.*).—Blackcap. Bénédictin.

Léotaud, p. 239.

Not common. I found it only in the forests, where it frequented trees bearing fruit, on which it fed. The only note I heard was a loud, reedy *cack*, not unlike that which can be produced with a duck-call.

97. Pachyrhamphus albogriseus *Scl.*

TAYLOR, p. 87.

98. Pachyrhamphus niger *Spix.* — BLACK HARDBEAK. BEC DUR.

TAYLOR, p. 87.
Tityra nigra LÉOTAUD, p. 241.

Not common. It seemed to favor second-growths.

99. Chasmorhynchus variegatus (*Gm.*).— BELL-BIRD. CONG. CAPUCIN. CAMPANERO.

Chasmorhynchus niveus TAYLOR, p. 88.
Chasmorhynchus variegatus SCL. Ibis, 1866, p. 407; *ibid.* 1867, p. 108.
Procnias variegata LÉOTAUD, p. 259.
Procnias nivea LÉOTAUD, p. 261.

As Dr. Sclater remarks, there is doubtless but one species of Bell-bird in Trinidad. Mr. Taylor's record was not based on specimens of *niveus*, nor are there specimens of this species in the Léotaud Collection.

From many sources I was told that the Campanero was frequently heard in the Moruga forests. I made several trips to localities said to be favored by it, but was not fortunate enough to meet with one.

Family DENDROCOLAPTIDÆ.—WOOD-CREEPERS, OVENBIRDS, ETC.

100. Sclerurus albigularis *Swains.*

On three occasions I met with single individuals of this bird. They were on the ground in the forest, and uttered sharp, metallic notes of alarm.

101. Synallaxis cinnamomea (*Gm.*).—GUIOUTI DES JONCS.

Synallaxis ruficauda LÉOTAUD, p. 155.

This species was met with only at the mouth of the Cipero River.

102. Synallaxis albescens *Temm.* GUIOUTI.

Synallaxis ruficapilla LÉOTAUD, p. 153.

A not uncommon species in the tall grasses of some uncultivated cacao groves or clearings. It clings to the grass stalks in a manner which reminds one of a Marsh Wren. Its song, which is uttered with great persistency, consists of two wheezy notes twice repeated, thus: *wèr-chee, wèr-chee.* On being alarmed it has a sharp rolling twitter.

The immature bird of this species differs from the adult in lacking the rufous cap and wing-coverts, and in being washed with brownish below.

103. Synallaxis terrestris *Jard.*—GUIOUTI À GORGE GINGA.

Synallaxis cinerascens LÉOTAUD, p. 152.

104. Xenops rutilus *Licht.*—PETIT GRIMPEUR.

TAYLOR, p. 85; LÉOTAUD, p. 156.

105. Dendrocincla merula meruloides (*Lafr.*).—LITTLE CACAO INSECT-PECKER. PETIT MANGEUR DE CACAO.

Dendrocops meruloides LÉOTAUD, p. 167.

A common species in the forests and cacao groves, where it resembles a Creeper in habits. It is apparently a very silent bird; the only notes I heard from it were a low *chŭh, chŭh.*

106. Dendrocolaptes altirostris *Léotaud.*—CHARPENTIER À BEC COURBE.

LÉOTAUD, p. 166.

The type of this species, according to Léotaud, was submitted to Lafresnaye, who considered it a valid species. It is not now represented in the Léotaud Collection.

107. Dendrornis susurrans (*Jard.*).—CACAO INSECT-PECKER. MANGEUR DE CACAO.

TAYLOR, p. 85.
Nasica sussurans LÉOTAUD, p. 160.

Common. It frequents the forests and cacao groves, and is generally seen in pairs. It secures its food not by drilling, as do Woodpeckers, but from crevices in the bark, etc., as do the true Creepers (*Certhia*). The usual call of this species is a short *kée-*

you, so exactly like the call of a High-hole (*Colaptes auratus*) that were the two birds calling it together it would not be possible to distinguish them by their notes. In addition to this call it has a loud, musical piping whistle, composed of quarter notes. This greatly resembles the call of *Galbula*, but is louder.

My series is very uniform in coloration, and, beyond a slight difference in intensity of coloration, presents little variation.

108. **Dendroplex picus** (*Gm.*).—MANGROVE PECKER. CHARPENTIER DES MANGLES.

Dendrocolates picus LÉOTAUD, p. 164.

109. **Picolaptes albolineatus** (*Lafr.*). — CHARPENTIER RAYÉ.

Picolaptes lineaticeps LÉOTAUD, p. 158.

Observed on only two occasions.

Family FORMICARIIDÆ.—ANT-BIRDS.

110. **Thamnophilus major** *Vieill.*—COUCOU.

TAYLOR, p. 85.
Thamnophilus stagurus LÉOTAUD, p. 266.

A common species, living in the lower growth in and at the borders of the forest. My experience with it may be given by several quotations from my journal:

"March 15.—I identified this evening the call of *Thamnophilus major*. The bird was thirty feet from the ground in a tree in the forest. Its low call commenced very slowly and deliberately, *chŭh—chŭh—chŭh*, getting faster and faster, until one could not distinguish the syllables, and ending quite unexpectedly in a long, drawn out *chāār*, so unlike the preceding notes, I could not believe, at first, that they were uttered by the same bird."

A bird seen on April 6 seemed by its actions to explain the use of the concealed white dorsal patch of this species. To quote again from my journal: "Two males were wooing a female. She remained in the undergrowth, while, most of the time, they were in the lower trees above her. Her preference I had no means of knowing, but certainly there was no question as to which was the most valorous of the males. One was a cringing, cowardly fellow who made no attempt at display, and uttered a whining note as the other chased him about. The other was a most gallant wooer. After a vigorous rush at his ever-fleeing rival he would pose, presumably for the benefit of the modest brown bird below him. Throwing out his breast, he raised his head until the bill pointed slightly backwards, and remained this way for several seconds. It was a position typical of the vaunting, defiant conqueror. His crest was raised, his red eye glared, and in the centre of the back was a distinct white line, which at times increased to a large round spot. This was visible both when he was at rest and on the wing, and was evidently displayed as an adornment. In the other male it was not visible."

111. Thamnophilus doliatus (*L.*).—Pintade.

Taylor, p. 85; Léotaud, p. 264.

A very common bird at the borders of the forests and in thickets of second-growth, beyond which, except for occasional visits to neighboring cacao groves, it was never seen. The calls of both sexes are alike. Their common note is a long-drawn rolling call, resembling in character, but easily distinguishable from, that of *T. major*. It is not concluded by the singular *chāār* of *major*, but *doliatus* has a somewhat similar note which it utters without reference to its regular call. This is a hoarse *cāār*, and might be mistaken for the *caw* of a Fish Crow. At times it utters also low croaks.

112. Thamnophilus cirrhatus (*Gm.*).—Charbonnier.

Thamnophilus atricapillus Taylor, p. 85; Ridgw. Proc. U. S. N. M. VII, 1884, p. 173.
Formicarius cirrhatus Léotaud, p. 195.

This bird was found more or less commonly at all points on the coast which I visited, but was not seen in the interior.

It resembles *T. doliatus* in habits, and the only call I heard was not unlike the rolling call of that species.

113. Dysithamnus mentalis spodionotus (*Salv. & Godm.*).

This bird was found in small companies of not more than six individuals in the lower trees in the forests. They were generally associated with *Myrmotherula axillaris*. Their call, of three or four low, sweet notes, is given by both sexes. It is Thrush-like in tone, and resembles the soft, querulous alarm notes of a Robin (*Merula migratoria*).

Adult males agree with the description of this race in being nearly concolor above, and in having the underparts without an olivaceous wash.

114. Myrmotherula axillaris (*Vieill.*).—Petit Charbonnier.

Taylor, p. 85.
Formicarius axillaris Léotaud, p. 194.

Found in the forests, where, in company with *Dysithamnus*, it frequented the lower trees. The only note I identified was a low *cack*.

115. Formicivora intermedia *Cab.*

Taylor, p. 85.

116. Myrmeciza longipes[1] albiventris *Chapm.*—Petit Fourmilier.

Myrmeciza longipes albiventris Chapm. Auk, X, 1893, p. 342 (preliminary descr.).
Formicarius longipes Léotaud, p. 191.

Char. subsp.—Similar to *Myrmeciza longipes* (Swains.), but somewhat smaller, and with the flanks and abdomen but slightly or not at all washed with cinereous.

Description of Type (No. 59,329, Coll. Am. Mus. Nat. Hist., adult male, Princestown, Trinidad, March 10, 1893; Frank M. Chapman).—Back and exposed surface of the wings rufous brown, tail slightly darker, crown and hindneck darker than the tail, bordered laterally and anteriorly by cinereous; throat, breast, cheeks and ear-coverts black; sides of the breast with a slight cinereous wash; abdomen white, sharply defined from the black breast; sides washed with fulvous brown, heavier on the flanks and crissum; feet and legs flesh color, bill black; anterior parts of the skin of the head and throat in life deep, dull blue. Female similar to the female of *longipes*.

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[1] The continental form of this bird has long been known as *Myrmeciza longipes* (Vieill.) Count von Berlepsch has shown, however, that Vieillot's description undoubtedly does not apply to this bird, and he has therefore renamed it *Myrmeciza swainsoni* Berl. In doing this, Count von Berlepsch considers that the *Drymophila longipes* of Swainson, while answering exactly to the *Myrmeciza longipes* of authors, is a synonym of the unrecognizable *Mymothera longipes* of Vieillot. I cannot agree with this decision, and prefer to accept Swainson's name, the synonymy of which will stand as follows:

Myrmeciza longipes (*Swains.*).

Drymophila longipes Swains. Zool. Journ. 1824, II, p. 152 (not *Mymothera longipes* Vieill. Nouv. Dict. XII, 1817, p. 113).
Myrmeciza longipes of most authors.
Myrmeciza swainsoni Berl. Ibis, 1888, p. 130; Salv. & Godm. Biol. Cent. Am. II, p. 229.

Ten males from Trinidad compared with two from Panama and one from Carthagena show that while the characters on which this new form is based are slight, they are constant and easily recognizable.

This is a very common species in the vicinity of the rest-house. It is found in pairs in the second-growth, and also in the dense undergrowth at the borders of the woods, but I never saw it in the depths of the forest. It passes most of the time on the ground, gleaning among the leaves, with which it harmonizes so exactly in color that unless its breast is turned toward one it is exceedingly difficult to distinguish the bird from its surroundings. They are unsuspicious birds, and by using a little caution one can approach to within a few feet of them. The call of the male is a loud, ringing whistle. The first note is the highest and loudest ; the call then descends, and at the same time decreases in volume and rapidity. It has all the *suddenness* of the calls of some Rails, and when heard at short range is a startling performance. The female, as far as I could learn, does not utter this call, but at its conclusion she frequently adds an appreciative twitter. Although so much of a ground bird, this species does not walk but hops.

117. Rhamphocœnus melanurus trinitatis (*Less.*).—Echelette.

Rhamphocænus trinitatis Lesson, Rev. Zool. 1839, p. 42.
Rhamphocænus melanurus Léotaud, p. 168.

A not uncommon bird, frequenting in pairs low second-growth or the smaller trees at the border of the forest. It is a nervous, active little bird, constantly on the move, and its long tail is twitched about with all the energy of a Wren. Its call is a monotonous, high, rattling, metallic trill.

The Trinidad bird is well deserving of recognition as a race. It resembles *melanurus* in the coloration of the underparts, but has the head, nape, cheeks and sides of the neck rufous brown, as in *R. rufiventris.*

118. Heterocnemis nævia (*Gm.*).—Bécassine à rivière.

Formicarius lineatus Léotaud, p. 192.

At the rest-house this species was rather rare, and was found only near brooks in the forest. On the banks of the Moruga and Caroni Rivers they were apparently common in the mangroves. As far as my experience goes they are shy, active, nervous birds, reminding me in their movements of a Water Thrush and the Carolina Wren. They feed on the shore of the brooks or from projecting roots, twitching out water-soaked leaves with a flirt of the bill. Their notes are sharp and metallic, resembling somewhat those of *Sclerurus*, or, when joined in a long rattling call, they suggest a similar performance by the Carolina Wren.

119. **Formicarius analis saturatus** (*Ridgw.*). — COQ-BOIS.

Formicarius saturatus RIDGW. Proc. U. S. N. M. XVI, 1893, p. 677.
Formicarius hoffmanni LÉOTAUD, p. 187.

This species is found only in the forests, where it is not uncommon, but is much more frequently heard than seen. Its usual call consists of four loud, clear, flute-like whistles; the first is the highest and longest, the last three are about one-third the length of the first. Occasionally the concluding notes are repeated many times, and are then given more rapidly. When heard in the depths of the dark, silent forest the musical notes of this bird are sure to command the attention of the most unobservant. The bird readily responds to even a poor imitation of its call, and walks rapidly towards the point at which its supposed friend or foe is stationed. I was struck not alone by the promptness with which they replied, but by the ease with which they located the position of the caller. On one occasion, while watching for Agoutis from a hunter's perch in the forest, I answered a Coq-bois which was whistling not nearer to me than seventy-five yards. I called only once, but in a few minutes the bird came directly to me, and, pausing almost beneath my perch, called frequently, at the same time looking anxiously from side to side. After circling about for several minutes it started to return by the same route it had come, but on my whistling it at once came back to me.

The Coq-bois is preëminently a ground bird. It is difficult to make it fly, and it takes wing only as a last resort. Its flight is then short, and resembles somewhat that of a Sora Rail (*Porzana carolina*). It walks quickly and gracefully over the fallen leaves, sometimes mounting fallen logs, but never, so far as I observed, perching in the branches of bushes or trees. When walking, and even when feeding, the tail is carried erect at right angles to the back, and the reddish brown crissum is then a conspicuous character.

Order MACROCHIRES.

Hummingbirds, Swifts, Goatsuckers, etc.

Family TROCHILIDÆ.—HUMMINGBIRDS.

120. **Glaucis hirsutus** (*Gm.*). — BROWNBREAST. COLIBRI BALISIER.

Glaucis mazeppa TAYLOR, p. 90.
Polytmus hirsutus LÉOTAUD, p. 139.

One of the most common species of Hummingbirds. They frequented only the lower-growth, and I do not remember ever having seen one more than fifteen feet from the ground. Their favorite resort was among the luxuriant 'wild bananas' (*Heliconia*), in or at the borders of the forests, from the flowers of which they obtained a large part of their food.

These flowers average one and one-half inches in length, are slightly curved in shape, and have the petals tightly wrapped together about the pistils. They stand upright in rows in the conspicuous *Heliconia* cups. In probing them the Hummingbirds insert their bill by a downward thrust, made from a position above the flower, and then let their body fall to a level below that of the top of the flower. They are enabled to assume this position through the curved shape of their bill, which corresponds exactly to the curve of the flower. This method of feeding is so marked a characteristic of this species, as I observed it, that it seems not improbable that the habit has resulted in modifying the shape of the bird's bill. At times they alight on the edge of the cup, and probe the flower more at leisure.

They also feed on insects taken from the under sides of leaves. These were captured with the tongue, which is capable of being extended an inch beyond the tip of the mandibles.

On rare occasions I heard this species sing a weak song.

121. Pygmornis longuemareus (*Less.*).—COLIBRI À RAQUETTE. RATCHETTE.

TAYLOR, p. 91; LÉOTAUD, p. 128.

Found in about the same numbers as *Glaucis hirsutus*, which it closely resembles in distribution and habits.

This species has a song of decided character. The circumstances under which I first heard it may best be described by a quotation from my journal under date of March 2: "As I entered a growth of low 'roseau' palms I was attracted by a chorus of squeaky voices, which at first I attributed to *Arbelorhina*. They seemed to be near the ground and very close to me, but, look as carefully as I would, I could see neither birds nor moving leaves. Finally, after several minutes, I espied a tiny Hummingbird perched on a twig about ten feet from me, and one foot from the ground. He was quivering with song. His bill was upraised, and his body trembled with the violence of his vocal effort. It was not much of a song, as songs go, but for a Hummingbird it was a remarkable performance. It consisted of seven notes, *swer-e-e-e-e-e-wèr*, the first six the same, the last accented and lower.

Not less interesting than the bird's song was its surroundings. This species is a dull, brownish bird with only a faint greenish tinge on the back, and is thus without the brilliant colors of other Hummers. The space beneath these low palms was partly filled with hanging or fallen dead, brown palm leaves. It was among these *Pygmornis* was perching. It was not too dense to see for a distance of twenty feet in any direction, but so exactly did the bird harmonize with its surroundings in color that even when within a few feet of me it was almost invisible. Their songs came from every side, a chorus of them, but only by the closest scrutiny and with help from my negro guide could I see birds which were singing vigorously and continuously within ten feet of me. Where the palms merged into other undergrowth the Hummers were no longer seen.

Subsequent experiences seemed to show that although the species was generally distributed, this locality was a favorite one for it, and as a rule I always found at least a few birds singing there.

122. Phaëthornis guyi (*Less.*).—Brin-blanc.

Taylor, p. 90; Léotaud, p. 129.

Not common, and always found in the depths of the forest, where it lived near the ground.

123. Lampornis violicauda (*Bodd.*).—Mango Hummer. Plastron.

Lampornis mango Taylor, p. 91.
Polytmus mango Léotaud, p. 131.

Observed commonly only while the bois immortel was blooming.

124. Lampornis gramineus (*Gm.*).—Roscal. Haussecol. Woscal.

Taylor, p. 91.
Lampornis dominicus Léotaud, p. 132.

125. Florisuga mellivora (*L.*).—Jacobine.

Taylor, p. 91.
Topaza mellivora Léotaud, p. 141.

Very common about the blooming bois immortel, but after they had passed out of blossom it was rarely observed. Its white tail, when the bird was on the wing, was generally spread to the utmost, while the white collar was also frequently displayed.

Two specimens, one nearly adult, the other obviously a bird of the year, have the outer pair of tail-feathers without black tips; the next pair have a black terminal spot on their inner web, and a narrow black margin along the greater part of the outer web; the remaining pairs are broadly tipped with greenish blue, and more or less margined with blackish.

126. Lophornis ornatus (*Bodd.*).—Whiskerando. Coquette. Huppe-col.

Taylor, p. 91.
Mellisuga ornata Léotaud, p. 148.

127. Calliphlox amethystina (*Gm.*).—AMÉTHYSTE.

Calothorax enicurus LÉOTAUD, p. 143.

128. Chrysolampis mosquitus (*L.*).—RUBEY AND TOPAZ. RUBIS-TOPAZE.

TAYLOR, p. 92.
Mellisuga moschita LÉOTAUD, p. 145.

A female was secured at the rest-house, and an adult male observed on the Caroni River.

129. Petasophora delphinæ (*Less.*).—BLUE-EARED HUMMER. COLIBRI À OREILLES.

Polytmus delphinæ LÉOTAUD, p. 134.

130. Floricola longirostris (*Vieill.*).—CARMINE. GORGE CARMIN.

Heliomaster longirostris TAYLOR, p. 92.
Mellisuga longirostris LÉOTAUD, p. 147.

131. Agyrtria chionipectus (*Goula*).—WHITE-BREAST. COLIBRI À GORGE BLANCHE.

Thaumantias chionipectus TAYLOR, p. 92.
Polytmus chionopectus LÉOTAUD, p. 140.

Not uncommon. A nest of this species, found March 3, was about twelve feet from the ground, saddled on a small twig near its end. Only one bird, presumably the female, was ever seen near the nest. She apparently began to sit about March 5. I did not learn on what date the one young bird was hatched, but it left the nest April 10.

132. Polytmus thaumatias (*L.*).—PEARL. VERT-PERLÉ.

Chrysobronchus virescens TAYLOR, p. 92.
Polytmus viridis LÉOTAUD, p. 135.

133. Amazilia erythronota (*Less.*). — EMERALD. RAIMÓNDE.

Erythronota antiqua TAYLOR, p. 92.
Polytmus erythronotus LÉOTAUD, p. 137.

Not common.

134. Eucephala cærulea (*Vieill.*).—Saphir.

Taylor, p. 92.
Hylocharis cærulea Léotaud, p. 150.

The commonest of the tree-haunting Hummers.

135. Chlorostilbon atala (*Less.*).

Taylor, p. 92.

136. Panyptila cayanensis (*Gm.*).—Hirondelle à gorge blanc.

Cypselus cayennensis Léotaud, p. 81.

Common at La Brea, the only locality at which it was observed.

137. Chætura cinereiventris lawrencei *Ridgw.*—Rain-bat. Petite hirondelle à croupion gris.

Chætura lawrencei et *C. cinereiventris lawrencei* Ridgw. Proc. U. S. Nat. Mus. XVI, 1893, p. 43.
Acanthylis oxyura Léotaud, p. 84.

Less common than *Chætura spinicauda*, with which it was found associated.

138. Chætura spinicauda *Temm.*—Rain-bat. Hirondelle à croupion gris.

Acanthylis poliourus Léotaud (in part).

Common in scattered companies of ten to thirty individuals, which night and morning coursed rapidly over the forests and clearings, generally out of gunshot. Their notes resemble in character those of our *Chætura pelagica*, but they are not so loud and are less frequently uttered.

139. Chætura polioura (*Temm.*).—Hirondelle à croupion gris.

Acanthylis poliourus Léotaud, p. 86 (in part).

I secured one specimen at La Brea.

140. Hemiprocne zonaris (*Shaw*).—Ringed Growrie. Hirondelle à collier blanc.

Acanthylis collaris Léotaud, p. 83.

141. Cypeloides rutilus (*Vieill.*)—Hirondelle à collier roux.

Hirundo rutila Léotaud, p. 87.

There is one specimen in the Léotaud Collection.

142. Chordeiles acutipennis (*Bodd.*).—Nighthawk. Engoulevent à queue fourchue.

Chordeiles minor Léotaud, p. 76.

143. Nyctibius jamaicensis (*Gm.*).—Potoo. Gros Engoulevent.

Nyctibius pectoralis Taylor, p. 90.
Léotaud, p. 70.

There is an animal in the Trinidad forests whose call is so inexpressibly sad that it affects even the negroes, and they have given to its author the name of "Poor-me-one," meaning, "poor me, all alone." These words express in a measure the hopeless sorrow of a voice which is so sweet and human in quality that it might easily be considered a woman's rich contralto. This impressive call is heard only at night. At the rest-house I heard it only on moonlight nights, and then at infrequent intervals. It is generally supposed to be uttered by the little Ant-eater (*Cyclothurus didactylus*), which, for this reason, is commonly known as Poor-me-one. I am told, however, by Mr. Albert B. Carr of Trinidad, a gentleman who is very familiar with the animals of the forests, that the Poor-me-one is in reality a Goatsucker, and that he has shot the bird in the act of calling. Unfortunately the bird was not preserved, so for the present its specific identity must remain in doubt. I have placed these remarks under *Nyctibius* for the reason that Waterton's description of the "largest Goatsucker in Demerara" with little doubt refers to what in Trinidad is known as Poor-me-one. Gosse, however (Birds of Jamaica), does not describe this call, and as it does not seem possible that so close an observer could have overlooked it, it is probable Waterton may have erred in his identification.

144. Lurocalis semitorquatus (*Gm.*).—Engoulevent à taches rousses.

Taylor, p. 90.
Lurocalis gouldii Léotaud, p. 74.

145. Podager nacunda (*Vieill.*).—Nacunda. Engoulevent à collier blanc.

Podager nacauda Léotaud, p. 79.

146. **Nyctidromus albicollis** (*Gm.*).—Engoulevent des Chemins.

Nyctidromus guianensis Taylor, p. 90.
Caprimulgus albicollis Léotaud, p. 72.

Common. Its notes resemble those of the Texan *N. a. merrilli*, but are not so loud and lack the bass undertone. They feed at night in the roads and footpaths, and for this reason are called by the natives by a Spanish name meaning Watchman of the Road. This habit causes their notes to be popularly translated as: '*I sèe you, I sèe you*, or, *whò arè you, whò arè you*,' while a less frequent and very different call is also excellently given as: '*I wòrk, I wòrk, I wòrk—wèll.*'

147. **Steatornis caripensis** *Humb.*—Guàcharo. Diablotin.

Taylor, p. 88; Léotaud, p. 65; Ridgw. Proc. U. S. N. M. VII, p. 173; Hornaday in Standard Nat. Hist. IV, 1885, p. 386.

May 5 I visited the Guàcharo cave on Huevos Island described by Mr. W. T. Hornaday (l. c.), but I can add nothing to his excellent description of it. I estimated the number of birds in this cave at 200, a number which I find corresponds with that given by Mr. Hornaday. A female secured was laying, and my guide, Mr. Morrison, the discoverer of the cave, of whom Kingsley wrote over twenty years ago, was of the opinion that the birds nested more or less every month in the year.

A second cave which I visited is situated on the main island of Trinidad in the first Boca. It contained apparently not more than fifty birds. There is no beach or floor in this cavern; the water reaches to its innermost parts, and as the walls are precipitous I was unable to explore it for nests.

148. **Chloronerpes rubiginosus** (*Swains.*).—Blue-headed Woodpecker. Charpentier à tête bleue.

Taylor, p. 93; Léotaud, p. 339.

Much less common than *Dendrobates kirkii*, which it greatly resembles in habits.

149. **Dendrobates kirkii** (*Malh.*).—Little Red-headed Woodpecker. Petit Charpentier à tête rouge.

Chloronerpes kirkii Léotaud, p. 341.

Common. Its call, a strong, high, penetrating *chee, chee, chee*, was heard nearly every day.

150. Celeus elegans (*Müll.*).—YELLOW-HEADED WOODPECKER. CHARPENTIER À TÊTE JAUNE.

Celeus cinnamomeus TAYLOR, p. 93; LÉOTAUD, p. 338.

151. Campephilus melanoleucus (*Gm.*). — BIG RED-HEADED WOODPECKER. CHARPENTIER À TÊTE ROUGE.

Dryocopus albirostris LÉOTAUD, p. 334.

Three were secured.

152. Ceophlœus lineatus (*L.*).—BLACK-THROATED WOODPECKER. CHARPENTIER À GORGE RAYÉE.

Dryocopus erythrops TAYLOR, p. 93.
Dryocopus lineatus LÉOTAUD, p. 336.

Not uncommon.

153. Momotus swainsoni *Gray.*—KING OF THE WOODS. HOUTOU.

TAYLOR, p. 88.
Momotus bahamensis LÉOTAUD, p. 96.

This is apparently an uncommon bird in the vicinity of the rest-house. I observed it on only three occasions, and it was unknown to the natives. One bird, which I watched for some time, made a low, clucking sound, which was accompanied by a quick, but deliberate wagging of the tail from side to side. Occasionally this motion was varied by a rapid, circular sweep, when the pendulum-like wagging was resumed.

154. Ceryle americana (*Gm.*).—RED-BELLIED KINGFISHER. MARTIN-PÊCHEUR À POITRINE ROUGE.

LÉOTAUD, p. 112.
Chloroceryle americana TAYLOR, p. 88.

A few pairs were seen on the Caroni, Cipero, and Moruga Rivers, and one pair frequented a small stream in the forest near the rest-house. On one occasion the male of this pair was perched on a stump over the brook, holding in his bill some food. The female came and alighted near him, and he immediately passed the delicacy over to her.

Their call when on the wing is a sharp, rattling twitter, not in the least resembling the call of *C. alcyon.* When they alight this is changed to a rapid, excited *ticking*, like the ticking of a clock which has been disturbed. Gradually this decreases in rapidity and volume, and in less than half a minute ceases.

155. **Ceryle superciliosa** (*L.*).—LITTLE KINGFISHER. PETIT MARTIN-PÊCHEUR.

LÉOTAUD, p. 114.
Chloroceryle superciliosa TAYLOR, p. 88.

156. **Ceryle alcyon** (*L.*).—BELTED KINGFISHER. MARTIN-PÊCHEUR À CEINTURE BLEUE.

LÉOTAUD, p. 108.

157. **Ceryle amazona** (*Lath.*).—AMAZON KINGFISHER. MARTIN-PÊCHEUR À LONG BEC.

LÉOTAUD, p. 111.

158. **Ceryle torquata** (*L.*).—GREAT KINGFISHER. GROS MARTIN-PÊCHEUR.

LÉOTAUD, p. 106.

159. **Trogon collaris** *Vieill.*—COLLARED TROGON. COUROUCOU À VENTRE ROUGE.

TAYLOR, p. 88; LÉOTAUD, p. 103.

This species was found in the forest six miles south of the rest-house, where I shot one individual and observed another. Its notes were a soft *coo-coo*, like those of *T. viridis*, but they were uttered so slowly my attention was at once attracted by them.

160. **Trogon viridis** *Linn.*—COUROUCOUAI. GRAND COUROUCOU À VENTRE JAUNE.

TAYLOR, p. 88; LÉOTAUD, p. 98.

Common. It frequents the denser parts of the forest, and rarely, if ever, makes extended flights. I have seen them, however, cross a small clearing, when their flight was strong and undulating, like that of a Goldfinch (*Spinus tristis*). The call of both sexes is alike, and consists of a melancholy *coo, coo*, repeated rather slowly many times. They feed on fruit, which they pick on the wing. Perching near a tree bearing their food, they make dashes at it, and then, like a Flycatcher, return to their perch to swallow it. From an experience with a wounded bird, I should judge that the sharp serrations on both mandibles are of great assistance to Trogons in this mode of procuring food.

161. Trogon meridionalis SWAINS.—LITTLE YELLOW-BELLIED TROGON. PETIT COUROUCOU À VENTRE JAUNE.

Trogon sulphureus LÉOTAUD, p. 101.

Quite as common as *T. viridis*, with which it was associated. Its notes are similar in tone to those of *T. viridis*, but are uttered more rapidly, and almost exactly resemble the long, rolling call of our High-hole (*Colaptes auratus*).

162. Galbula ruficauda *Cuv.*—JACAMAR.

TAYLOR, p. 88; LÉOTAUD, p. 116.

A not uncommon bird at the borders of and in the forests. Its appearance, at first sight, would seem to support its reputation for stupidity, but closer observation will, I think, induce one to believe that these birds are by no means so stupid as they have been said to be.

They are the most expert ' Flycatchers ' I have ever seen, and this, in spite of the fact that the shape of their bill would seem better to fit them for almost any other mode of existence. Sitting all *drawn in* on a dead limb, generally near the ground, they may be compared to a set spring. Their watchfulness permits no insect to pass in safety. They maintain a constant lookout, turning the head quickly from side to side, above, or even halfway around. The dart into the air is made with wonderful celerity. Sometimes it is straight up, again at various angles, and they go as far as thirty to thirty-five feet from their perch. As a rule they return to the same perch after each sally, and may occupy this for many minutes.

As they rest they utter a singular call—a loud, clear, piping whistle, not unlike the call of a lost duckling. This is delivered in a variety of ways. Sometimes it is given as a single whole note, when it may be repeated at intervals of a second for minutes at a time. The dart into the air for an insect interrupts this musical reverie only momentarily, and, on returning to their perch, the plaintive calling is continued. At other times their notes are uttered more rapidly, and may rise into a high, prolonged trilling. This may be *ground out* as revolutions of sound, when the effect is most peculiar.

163. Crotophaga ani *Linn.*—TICKBIRD. MERLE CORBEAU.

TAYLOR, p. 92; LÉOTAUD, p. 355.

Common in the cacao groves and second-growth, in flocks of six to twelve individuals. They were nesting in April, but I succeeded in finding only one nest. This was loosely made of sticks placed in the centre of a vine-covered limb, about twenty feet from the ground. It was completed about April 14, but although birds were generally seen at or near it, it was apparently not occupied at the time of my departure.

164. Crotophaga major *Gm.*—MARSH TICKBIRD. GROS MERLE CORBEAU.

TAYLOR, p. 93; LÉOTAUD, p. 358.

165. Diplopteryx nævius (*L.*).—TRINITÉ. TRINITÉ QUATRE AILES.

TAYLOR, p. 93; LÉOTAUD, p. 343; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.

A common, rather shy bird found in and near thicket-grown clearings. It passes much of its time on the ground, but frequently ascends to the topmost branches of the smaller trees to call. Its calls are also uttered from the ground. They are given more or less throughout the day, and were among the most pleasing and characteristic bird-notes heard near the rest-house. They are of two kinds, and one is heard quite as frequently as the other. Both are in a minor key; the first consists of two notes, the second half a tone lower than the first. The second call is translated by the negroes as *chloë, chloë, chloë-dead, chloë-dead.*

On one occasion, while watching one of these birds *walking* over some recently burned ground, I was surprised to observe a most singular action. The bird walked rapidly for a few yards, then stopping, raised and lowered its crest and turned the black feathers of the alula forward until they pointed toward the breast. This was repeated several times, and I find my observation confirmed by Léotaud's account, with which, at the time, I was not familiar.

166. Piaya cayana (*L.*).—Boocootoo. Coucou manioc.

Taylor, p. 93; Léotaud, p. 346.

Not common. I saw about a dozen individuals, which, with one exception, were in the forest. Their flight is weak, and consists of short sails followed by intervals of flapping. The only note I heard was a sharp *chick.*

167. Piaya minuta (*Vieill.*). — Lesser Piaya. Petit Coucou manioc.

Léotaud, p. 348.

Only six individuals were observed. In notes and habits they seemed to resemble the preceding species.

168. Coccyzus melanocoryphus *Vieill.* — Red-bellied Piaya. Coucou manioc à ventre roussâtre.

Piaya melacorypha Léotaud, p. 349.

169. Coccyzus minor (*Gm.*).—Mangrove Cuckoo. Coucou manioc gris.

Léotaud, p. 353.

170. Coccyzus erythrophthalmus (*Wils.*). — Black-billed Cuckoo. Coucou manioc à bec noir.

Léotaud, p. 352.

171. Coccyzus americanus (*L.*). — Yellow-billed Cuckoo. Coucou manioc aux ailes rousses.

Léotaud, p. 350.

A female was taken on Monos, May 4.

172. Ramphastos vitellinus (*Licht.*).—Toucan.

Taylor, p. 93; Léotaud, p. 325.

Common in the forests. Their call, a loud, harsh, double-noted whistle, was one of the characteristic notes heard at the rest-house. When calling the birds perch on the topmost limb of one of the taller forest trees and utter their unmusical notes for many consecutive minutes. Generally two could be heard at the same time. It was not usual to see them make extended flights unless clearings interrupted the continuity of the forests. In crossing these their flight consisted of alternate flapping and sailing. About a dozen rapid strokes were followed by a short, downward sail. They seemed to be shy, silent birds when among the lower branches feeding, and I did not have an opportunity to study their habits. Those seen in the trees were actively hopping from limb to limb, with their tails cocked up forming various angles with their backs, reminding one of gigantic Wrens.

173. Ara makawuanna (*Gm.*).—PETIT ARA VERT.

LÉOTAUD, Appendix, p. 557.

This species is given by Léotaud without remark. I did not meet with Macaws of any species, but received reliable information of the occurrence of some species of Ara, but whether the present or some other I could not determine with certainty.

174. Amazona amazonica (*L.*).—GREEN PARROT. GROS JACQUOT.

Chrysotis, sp? TAYLOR, p. 94.
Psittacus agilis LÉOTAUD, p. 327.

Common, and like most Parrots very restless, spending much time on the wing. Their notes were loud and discordant, and, so far as I learned, consisted of two kinds. One was uttered by a pair of birds when on the wing or, less frequently, when at rest. The other was a far more complicated series of squawks, and was heard only when two or more pairs came together.

A female, shot on March 4, had an egg in her oviduct ready to receive the shell.

175. Pionus menstruus (*L.*)—BLUE-HEADED PARROT. PERRUCHE À TÊTE BLEUE.

Psittacus menstruus LÉOTAUD, p. 329.

Common in pairs or small flocks of four to seven birds. They were generally seen passing over at a considerable height, and attracted attention by their notes.

176. Urochroma cingulata (*Scop.*). — SEVEN-COLORED PAROQUET. PERRUCHE À SEPT COULEURS.

Urochroma melanoptera TAYLOR, p. 94.
Psittacula batavica LÉOTAUD, p. 331.

Common in flocks of from three or four to thirty individuals. Their notes, which consist of a kind of squeaking twitter, were heard only when the birds were on the wing. When at rest or feeding they were silent. It was then exceedingly difficult to distinguish them from the leaves of the tree in which they were perching, and unless a bird moved it was practically invisible. Their favorite food seemed to consist of the fruit of the 'agalee' tree, with the sticky juices of which their bills were generally well covered.

I received from independent sources reliable information that these birds lay their eggs in the nests of the 'white ant,' 'ant-louse,' or termite. These nests are very numerous, and are generally placed thirty or more feet from the ground. They resemble in appearance enormous wasps' nests, and the Paroquets are said to deposit their eggs in holes which they make in the nest for this purpose. At the time of my visit the nesting season was presumably over, for I secured fully grown young of the year.

177. Urochroma hueti (*Temm.*).—RED-WINGED PAROQUET. PERRUCHE AUX AILES ROUGES.

Psittacula hueti LÉOTAUD, p. 332.

178. Strix pratincola *Bp.* — BARN OWL. CHOUETTE BLANCHE.

LÉOTAUD, p. 62.

The sudden, hissing scream of this Owl was occasionally heard at night.

179. Syrnium virgatum *Cass.*—TAWNY OWL. CHAT-HUANT.

LÉOTAUD, p. 60.

An Owl frequently heard calling at night in the forest I imagine from its notes to have been this species, but unfortunately I did not succeed in securing a specimen. Its cry consisted of the four notes, *hōō*, *hōō*, *hōō*, *hŏŏ*, the first three of equal length and on the same note, the last much lower.

180. Megascops brasilianus (*Gm.*). — EARED OWL. CHOUETTE À OREILLES.

Ephialtes portoricensis LÉOTAUD, p. 57.

Only one specimen was secured. I did not succeed in identifying the call of this species. An Owl heard nightly in the forest, and said by the natives to be this bird, had a call which may be given as *cook-er-re-coo*, sometimes running off into a series of *coos*. The call bears no resemblance to the trilling notes of our *Megascops*, but apparently is not unlike Hudson's description of that of *Megascops brasiliensis*, as found by him in the Argentine Republic (Arg. Orn., II, p. 51).

181. Pulsatrix torquata (*Daud.*). — COLLARED OWL. CHOUETTE À COLLIER.

Athene torquata LÉOTAUD, p. 52.

182. Glaucidium phalænoides (*Daud.*). — PETITE CHOUETTE.

Glaucidium ferrugineum TAYLOR, p. 80.
Athene phalænoides LÉOTAUD, p. 54.

An exceedingly common bird ; from the rest-house veranda I have heard five calling at the same time. Their usual note is a softly whistled *coo*, resembling in tone that of the Cuban *Glaucidium*, but the last-named bird utters this note about once every five seconds, while in Trinidad these little Owls *coo* four or five times a second. Their call becomes therefore a series of rapidly repeated *coos* continued for fifteen or twenty seconds. At times this runs into a sharply whistled *whoit*, *whoit*, *whoit*, apparently analagous to but not resembling the high piercing notes of the Cuban species. This, as in *G. siju*, is sometimes accompanied by a twitching of the tail. The Trinidad bird, while frequently heard during the day, called in numbers only at night and was thus nocturnal rather than diurnal, contrary to the habit of the Cuban bird.

The negroes consider this species a bird of ill-omen, and translate its rapid cooing as an invitation from the Evil One to "*come*, *come*, *come*," etc.

My specimens represent both extremes of the red and gray phases; in the former, with the exception of an indistinct blackish collar on the nape, the head, back and tail are rich reddish brown absolutely without spots or bars; while in the gray phase all the feathers of the head have a terminal and subterminal elongate, whitish spot; there is a nuchal collar; the feathers of the back and rump are more or less spotted with white, and the tail is banded with numerous broken white bars. These extremes are connected by other specimens intermediate both in color and pattern of marking.

183. Sarcoramphus papa (*L.*).—King Corbeau. Roi des Corbeaux.

Léotaud, p. 1.
Gyparchus papa Taylor, p. 79.

184. Cathartes aura (*L.*).—Cedros Corbeau. Corbeau à tête rouge.

Taylor, p. 78; Léotaud, p. 2.

Common about the rest-house.

185. Catharista atrata (*Bartr.*).—Town Corbeau. Corbeau.

Cathartes atratus Taylor, p. 77.
Cathartes fœtens Léotaud, p. 2.

This is the common Buzzard of the towns, and in Port-of-Spain is particularly abundant and tame. When a struggling flock were fighting in the main street over some savory morsel, it was almost necessary to kick them aside when passing through the street. Their usefulness as scavengers is unquestioned, but their habit of perching on the roofs of houses is a serious cause of annoyance to people owning cisterns used for rain-water. Many of them roost in the trees in Marine Square in the city, from which they sail forth on their day's exploring at about four A. M.

186. Ictinia plumbea (*Gm.*).—Plumbeous Kite. Gabilan bleu.

Léotaud, p. 42.

Common, and for a Hawk remarkably tame. Their favorite perch was on the topmost branch of a dead or leafless tree, from which point of vantage they would swoop down on the unwary birds below. Two birds selected perches near the rest-house, where they passed the day maintaining a constant outlook for a possible victim below. At sunset they retreated to the forest to pass the night. This species could always be approached without difficulty, and on two occasions I have had them swoop down to secure a bird which I had shot.

One newly occupied nest was found in March, and another in April. They were small, rather formless structures of sticks, placed in the main crotch of a tree about twenty feet from the ground.

187. **Elanoides forficatus** (*L.*).—Scissor-tailed Kite. Queue-en-ciseaux.

Nauclerus furcatus Léotaud, p. 30.

Observed on two occasions.

188. **Rostrhamus sociabilis** (*Vieill.*).—Hook-billed Kite. Gabilan à bec crochu.

Rostrhamus hamatus Léotaud, p. 31.

189. **Circus maculosus** (*Vieill.*).—Harrier. Gabilan à longue queue.

Circus macropterus Léotaud, p. 49.

190. **Buteo abbreviatus** *Cab.*—Small Black Buzzard. Petit Gabilan noir.

Buteo zonocercus Léotaud, p. 9.

191. **Urubitinga urubitinga** (*Gm.*).—Eagle-hawk. Gros Gabilan noir.

Morphnus urubitinga Léotaud, p. 14.

192. **Urubitinga anthracina** (*Licht.*).— Black Hawk. Gabilan noir.

Astur unicinctus Léotaud, p. 44.

193. **Urubitinga albicollis** (*Lath.*).—Gabilan à dos noir.

Buteo albicollis Taylor, p. 79.
Buteo pœcilinotus Léotaud, p. 7.

194. Asturina nitida (*Lath.*).—SPECKLED HAWK. GABILAN GINGA.

TAYLOR, p. 80.
Astur nitidus LÉOTAUD, p. 46.

195. Harpagus bidentatus (*Lath.*).—TOOTHED FALCON. GABILAN À DEUX DENTS.

LÉOTAUD, p. 28.

196. Gampsonyx swainsoni *Vig.*—BROWN HAWK. GRI-GRI.

Gampsonix swainsonii LÉOTAUD, p. 41.

197. Leptodon unicinctus *Temm.*—GABILAN BLEUÂTRE.

Cymindis unicinctus LÉOTAUD, p. 36.
Cymindis pucherani, *ibid.* p. 40.

198. Leptodon cayenensis (*Gm.*).—GUIANA HAWK. GABILAN À TÊTE BLEUE.

Cymindis cayanensis LÉOTAUD, p. 34.

Several were observed and two secured. With the exception of *Ictinia plumbea*, Hawks were not common near the rest-house. I saw probably but two species in addition to those identified.

199. Spizaëtus mauduyti (*Daud.*).—CRESTED SPIZAËTUS. GABILAN À HUPPE.

Spizaëtus ornatus LÉOTAUD, p. 10.

200. Spizaëtus tyrannus (*Wied*).—SPECKLED-LEG SPIZAËTUS. GABILAN À PATTES GINGA.

Spizaëtus braccata LÉOTAUD, p. 12.

201. Falco peregrinus anatum (*Bon.*).—DUCK HAWK. GABILAN RAYÉ.

Falco peregrinus TAYLOR, p. 80.
Falco anatum LÉOTAUD, p. 22.

202. Falco fusco-cærulescens (*Vieill.*).—BLACK-BELLIED FALCON. GABILAN À POITRINE NOIRE.

Hypotriorchis femoralis LÉOTAUD, p. 24.

While traveling by rail from Port-of-Spain to Princestown, I looked from the window of the carriage and saw a small *Falco*—

the species I could not determine—flying with the train and about sixty feet above it. For some time it maintained the same relative position, then suddenly, and with great swiftness, darted ahead and was lost to view. A few minutes later I observed a Hawk of the same species occupying the same position above the train as the one which had just disappeared. As I watched it this bird also darted ahead of the train. It was not long before a third Hawk was seen over the train, and, like its two predecessors, it suddenly shot forward. I then began to suspect that the three Hawks were in reality but one, whose object in following the train was to secure the small birds startled from near the track by our approach. The performance was repeated several times, and my surmise in part sustained by seeing the Hawk actually dive into a thicket just ahead of the engine. Indeed, it appeared that the train, like a spaniel, flushed the birds for the Hawk, which was 'waiting-on' overhead.

This explanation is further supported by a notice in the 'Journal' of the Trinidad Field Naturalists' Club (Vol. I, p. 133), where Mr. Caracciolo records the fact of a Hawk seen by Dr. Morton which "pounced upon" small birds frightened from a certain thicket by a passing train. The habit has been observed by Mr. Hudson in the Argentine Republic, where, he states, Duck Hawks follow horsemen in order to secure the small birds flushed from the grass by the horse.

203. Falco deiroleucus *Temm.*—White-throated Falcon. Gabilan à tête noire.

Léotaud, p. 17.

204. Falco rufigularis *Daud.*—Red-throated Falcon. Gabilan noir à gorge rousse.

Falco aurantius Léotaud, p. 20.

205. Falco columbarius *Linn.*—Pigeon Hawk. Gabilan à dos bleuâtre.

Hypotriorchis columbarius Léotaud, p. 26.

206. Falco sparverius *Linn.*—Sparrow Hawk.

Tinnunculus sparverius Taylor, p. 80.

207. Pandion haliaëtus carolinensis (*Gm.*).—FISH-HAWK. GABILAN PÊCHEUR.

Pandion haliaëtus TAYLOR, p. 79.
Pandion carolinensis LÉOTAUD, p. 15.

208. Columba speciosa *Gm.*—SPECKLED CUSHAT. RAMIER GINGA.

LÉOTAUD, p. 361.
Columba, sp. ? TAYLOR, p. 94.

Not uncommon in the forest in pairs. During the early morning and late afternoon the male perches on the topmost branch of one of the taller trees and utters his loud, deep solemn call. This may be given as *cook-a-loo-coo*, *cook-a-loo*, and is preceded by a low, rumbling note heard only when one is quite near the bird.

209. Columba rufina *Temm.*—BLUE CUSHAT. RAMIER MANGLE.

LÉOTAUD, p. 364.

210. Engyptila rufaxilla (*Rich. & Bern.*).—GROUND DOVE. TOUTERELLE à PAUPIÈRES ROUGES.

Peristera rufaxilla TAYLOR, p. 94; LÉOTAUD, p. 371.

A common bird in the forests and second-growth. It resembles a *Geotrygon* in habits, but is more frequently seen on the wing. Their flight is noiseless, a fact the attenuation of the first primary would not lead one to expect. When on the wing the neck is not extended, but rather drawn in, the bill pointing towards the earth.

The notes of this species formed a background for all other bird music. They resemble the winding notes of a mellow-toned conch. So close is the resemblance that, when in the forest in the early morning, with the soft cooing of these Doves proceeding from all sides, it was not difficult to imagine oneself surrounded by a cordon of conch-blowers. The sound was so continuous that the air vibrated with Doves' notes, and in a short time one became so accustomed to the chorus, that, like the monotonous humming of many insects, it was unnoticed.

A nest found March 10 was a simple platform of sticks placed eight feet from the ground in the main crotch of a small tree at the border of the forest. It contained two young, one of which flew from the nest as I approached.

This species was apparently wanting on Monos Island.

211. Engyptila verreauxi (*Bp.*).—GROUND DOVE. TOURTERELLE À PAUPIÈRES BLEUES.

Engyptila verreauxi RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Peristera verreauxi LÉOTAUD, p. 369.

Apparently a rare bird at the rest-house, where I secured only two specimens. On Monos, however, they were very common. Their call is similar to that of *E. rufaxilla*, but not so loud.

212. Peristera cinerea (*Temm.*).—BLUE PARTRIDGE DOVE. ORTOLAN BLEU.

LÉOTAUD, p. 378.

213. Columbigallina rufipennis (*Bon.*).—RED ORTOLAN. ORTOLAN ROUGE.

Chamæpelia albivitta TAYLOR, p. 95.
Chamæpelia rufipennis LÉOTAUD, p. 366.

Not uncommon in the clearings near the rest-house. Its note is a low, rapid, *put-a-coo*, *put-a-coo*, *put-a-coo*.

214. Geotrygon linearis (*Knip & Prév.*).—MOUNTAIN GROUND DOVE. TOURTERELLE À CROISSANT.

Peristera linearis LÉOTAUD, p. 373.

215. Geotrygon montana (*L.*).—PARTRIDGE DOVE. PERDRIX.

Peristera montana ? LÉOTAUD, p. 375.

216. Pipile pipile (*Jacq.*).—PAOUI.

Crax pipile JACQ. Beytr. zur Gesch. 1784, p. 26.
? Crax alector TAYLOR, p. 95.
Penelope cumanensis LÉOTAUD, p. 383.

I observed only one individual, an adult male, with blue throat and cheeks, shot from a tree in the forest three miles from the rest-house. The flesh of this species is deservedly esteemed, and through the persecution of hunters it is rapidly becoming a rare bird.

Comparison of my one example with specimens of *Pipile cumanensis* from the mainland shows at once well-marked differences. The Trinidad bird is dark brown with deep blue reflections and without the greenish tinge seen in the plumage of true *cumanensis*, while the lengthened feathers of the head are black with a narrow lateral margin of white. In *cumanensis* these feathers are entirely dirty white.

In fact, the Trinidad bird agrees very well with the plate and description of Jacquin's *Crax pipile*, a species which has been synonymized by subsequent writers with the same author's *Crax cumanensis*. There is one specimen of this bird in the Léotaud Collection. It agrees with my example, and is well described by Léotaud.

I could learn nothing of the occurrence of *Crax alector*, a species recorded from Trinidad by Mr. Taylor, who remarks that it is locally called "Wild Turkey." *Pipile pipile* is frequently called by this name. Is it possible that Mr. Taylor has confused the two species?

217. Jacana jacana (*L.*).—SPUR-WING. PAUL PERRUQUIER.

Parra jacana LÉOTAUD, p. 486.

218. Hæmatopus palliatus *Temm.* — OYSTER-CATCHER. HUITRIER.

LÉOTAUD, p. 397.

219. Arenaria interpres (*L.*).—TURNSTONE. PLUVIER DE MER.

Cinclus interpres LÉOTAUD, p. 399.

220. Ægialitis wilsonia (*Ord*). — WILSON'S PLOVER. GROS COLLIER.

Charadrius wilsonius LÉOTAUD, p. 391.

221. Ægialitis semipalmata *Bonap.* — RING-NECKED PLOVER. PETIT COLLIER.

Charadrius semipalmatus LÉOTAUD, p. 392.

Common at Moruga. I saw there also, but unfortunately failed to secure, a small Plover which apparently was *Ægialitis collaris*.

222. **Charadrius dominicus** (*Müll.*).—Golden Plover. Pluvier doré.

Charadrius virginicus Léotaud, p. 394.

223. **Charadrius squatarola** (*L.*).—Black-bellied Plover. Gros Pluvier doré.

Squatarola helvetica Léotaud, p. 389.

224. **Numenius borealis** *Lath.*—Eskimo Curlew. Petit Bec crochu.

Léotaud, p. 444.

225. **Numenius hudsonicus** *Lath.*—Hudsonian Curlew. Bec crochu.

Léotaud, p. 442.

226. **Actitis macularia** (*L.*). — Spotted Sandpiper. Richi.

Tringoides macularius Taylor, p. 95.
Tringoides hypoleuca Léotaud, p. 458. (Based on immature specimens.)
Tringoides macularia, ibid. p. 461.

Common on the Cipero and at Moruga.

227. **Tryngites subruficollis** (*Vieill.*).—Buff-breasted Sandpiper. Petit Pieds jaunes.

Tringa rufescens Léotaud, p. 470.

228. **Bartramia longicauda** (*Bechst.*). — Bartramian Sandpiper. Pieds jaunes à longue queue.

Tringoides bartramius Léotaud, p. 463.

229. **Symphemia semipalmata** (*Gm.*). Willet. Ailes blanches.

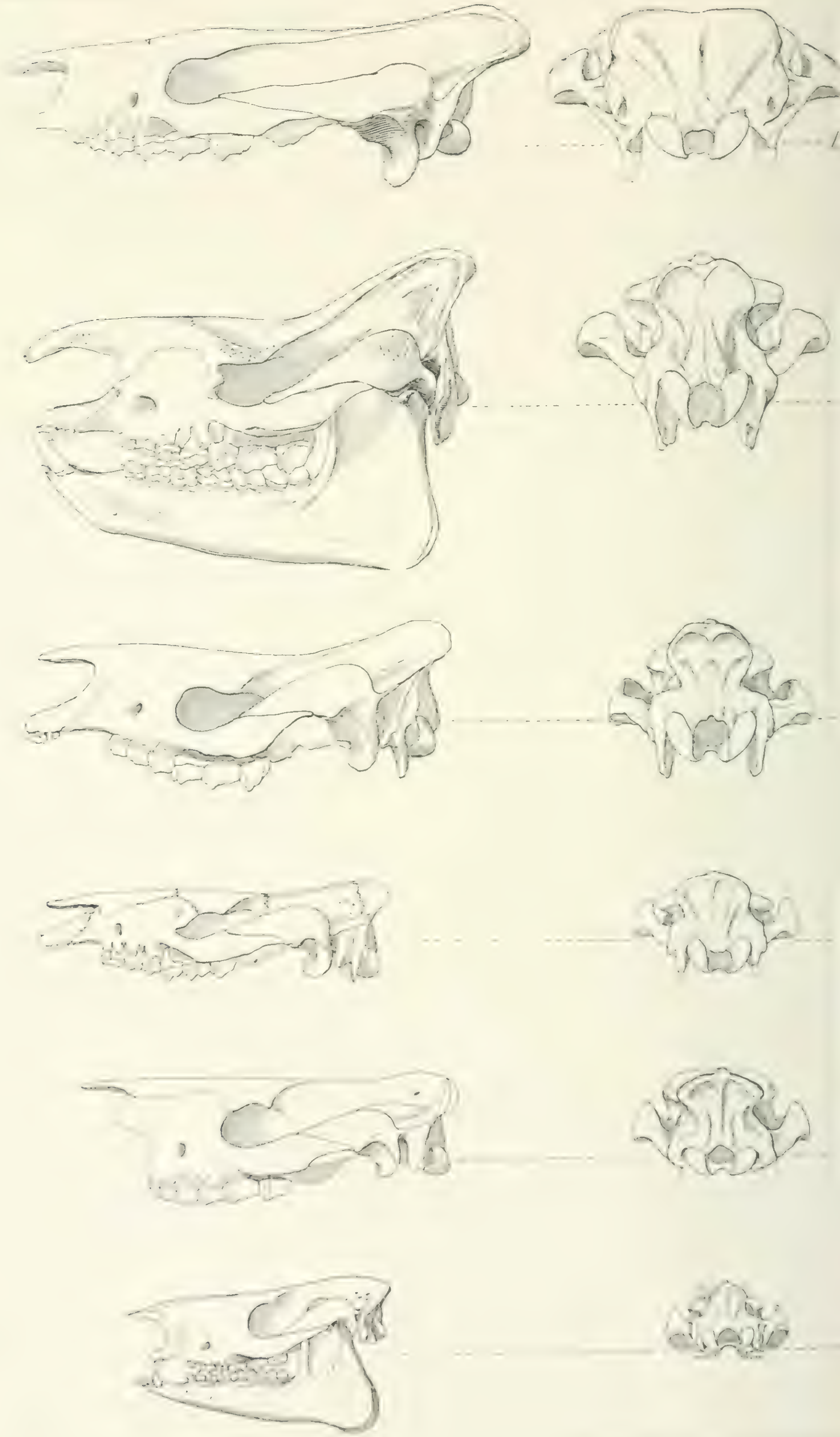
Totanus semipalmatus Léotaud, p. 456.

EXPLANATION OF PLATE III.

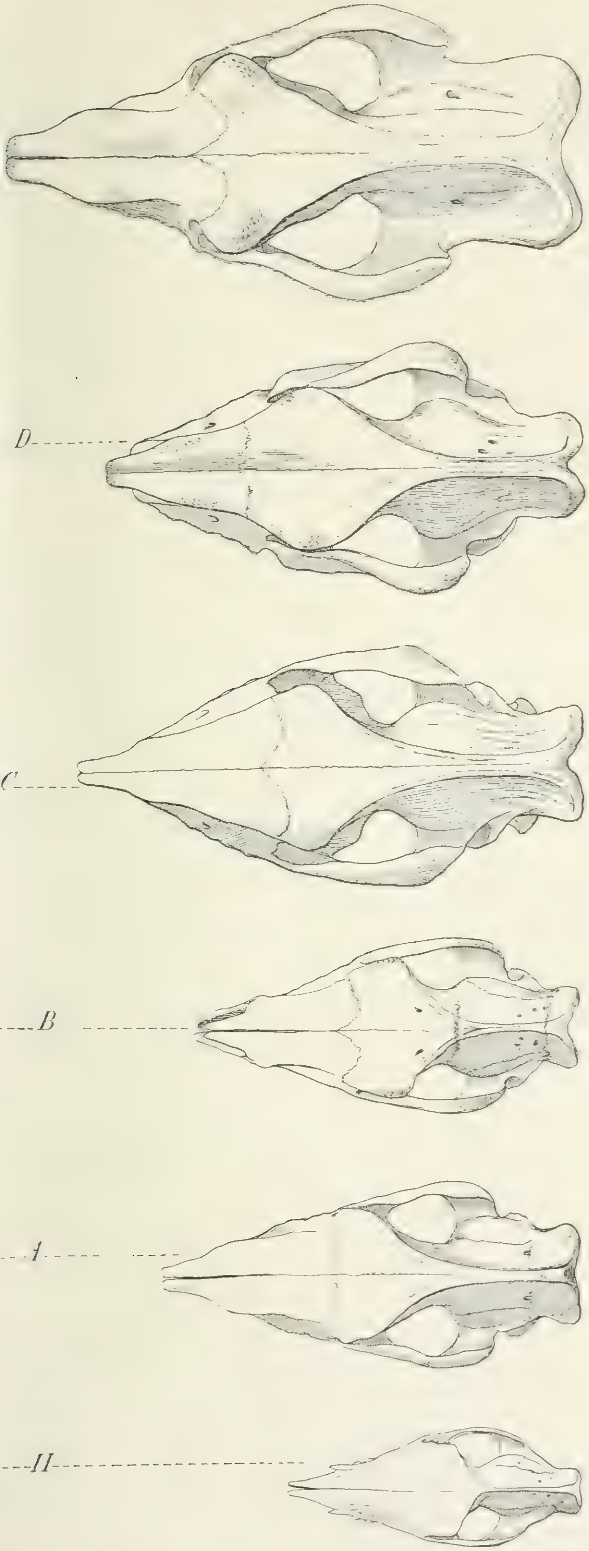
SKELETON OF ACERATHERIUM TRIDACTYLUM.

One-tenth natural size.

All parts are preserved and mounted as here represented, excepting : the left fore limb, which is restored from the right side, the great trochanter of the femur, and one or two caudals.



Lower Miocene Rhinocero


D
C
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230. Totanus solitarius (*Wils.*).—Solitary Sandpiper. Grandes ailes.

Totanus chloropygius Léotaud, p. 450.

231. Totanus flavipes (*Gm.*).—Yellow-legs. Pieds jaunes.

Léotaud, p. 452.

232. Totanus melanoleucus (*Gm.*).—Greater Yellow-legs. Clin-clin.

Léotaud, p. 454.

233. Limosa hæmastica (*L.*).—Hudsonian Godwit. Bécard ailes blanches.

Limosa hudsonica Léotaud, p. 447.
Limosa ægocephala, *ibid.* p. 448.

234. Limosa fedoa (*L.*).—Marbled Godwit. Grand Bécard.

Léotaud, p. 445.

235. Calidris arenaria (*L.*).— Sanderling. Bécasse blanche.

Léotaud, p. 480.

236. Ereuentes occidentalis *Lawr.*—Western Sandpiper. Bécasse à long bec.

Heteropoda longirostris et *H. mauri* Léotaud, p. 480.

There are four specimens of this bird in the Léotaud Collection.

237. Ereunetus pusillus (*L.*).—Semipalmated Sandpiper. Bécasse ordinaire.

Heteropoda semipalmata Léotaud, p. 476.

Several were observed, and one taken on the coast of Moruga.

238. Tringa minutilla *Vieill.*—Least Sandpiper. Petit-maître.

Léotaud, p. 476.

Not uncommon on the coast of Moruga.

239. **Tringa fuscicollis** *Vieill.*—White-rumped Sandpiper. Grosse Bécasse.

Tringa melanotus Léotaud, p. 472.

240. **Tringa maculata** *Vieill.*—Pectoral Sandpiper. Couchante.

Léotaud, p. 474.

241. **Tringa canutus** *Linn.*—Knot. Poule couchante.

Léotaud, p. 468.

242. **Micropalama himantopus** (*Bon.*).—Stilt Sandpiper. Chevalier.

Hemipalama multistriata Léotaud, p. 466.

243. **Macrorhamphus griseus** (*Gm.*). — Dowitcher. Grise à long bec.

Léotaud, p. 482.

244. **Gallinago delicata** (*Ord*).—Wilson's Snipe. Bécassine.

Gallinago wilsonii Léotaud, p. 484.

245. **Himantopus nigricollis** (*Müll.*). — Black-necked Stilt. Bécasse-la-mort.

Léotaud, p. 464.

246. **Heliornis fulica** (*Bodd.*). — Surinam Heliornis. Plongeon à queue.

Léotaud, p. 531.

247. **Fulica americana** *Gmel.* — American Coot. Foulque.

Léotaud, p. 504.

248. **Gallinula galeata** (*Licht.*).—Red-seal Coot. Poule d'eau à cachet rouge ; Coq-lagon.

Léotaud, p. 503.

The specimen in the Léotaud Collection has the back without a brownish wash, and of the same color as the wings.

249. **Ionornis martinica** (*L.*).—BLUE-SEAL COOT. POULE D'EAU À CACHET BLUE.

Porphyrio martinica TAYLOR, p. 96; LÉOTAUD, p. 501.

250. **Porzana carolina** (*L.*).—SORA. POULE-SAVANNE À GORGE NOIRE.

Ortygometra carolina LÉOTAUD, p. 493.

251. **Porzana albicollis** (*Vieill.*).—CRAKE. GROSSE POULE-SAVANNE.

SCLATER, P. Z. S. 1868, p. 451.
Crex olivacea TAYLOR, p. 96.
Corethura olivacea LÉOTAUD, p. 499.

252. **Porzana cinerea** (*Vieill.*).—LITTLE CRAKE. PETITE POULE-SAVANNE.

Porzana cinerea SCL. P. Z. S. 1868, p. 456.
Ortygometra cinerea LÉOTAUD, p. 495.

253. **Rallus maculatus** (*Bodd.*).—SPOTTED RAIL. POULE D'EAU TACHETÉE.

LÉOTAUD, p. 559.

254. **Rallus longirostris** (*Bodd.*).—CLAPPER RAIL. POULE D'EAU GINGA.

LÉOTAUD, p. 491.

255. **Aramides axillaris** *Lawr.* — RED WATER-FOWL. POULE D'EAU ROUGE.

Aramides ruficollis LÉOTAUD, p. 498.

I secured one specimen of this bird feeding in the mangroves which border the Moruga River near its mouth.

256. **Aramides cayennensis** (*Gm.*). — GREAT WATER-FOWL. GROSSE POULE D'EAU.

Aramides chiricota LÉOTAUD, p. 496.

Apparently a common species in the forests near the rest-house. I did not, however, succeed in seeing it alive, and my four specimens were secured in traps set for small mammals. Its call, upon the identification of which the natives were all agreed, is a remarkable performance. Apparently two birds call together; one has one series of notes while the other has another and quite different series. The result suggests the combined notes of a Guinea-hen and a Turkey-hen, with occasionally the addition of others not unlike the yelping of a whipped puppy.

This singular concert was not given every day, and during my stay at the rest-house I heard it only half-a-dozen times. The birds call at sunset, and the cries of one pair seem to excite their neighbors, for, once started, the call is taken up and repeated by birds in different parts of the forest.

257. Aramus scolopaceus (*Gm.*).—Crao.

Aramus guarauna Léotaud, p. 489.

I saw, but failed to secure, one individual, presumably of this species, at the rest-house.

258. Nycticorax violaceus (*L.*). — Yellow-crowned Night Heron. Crabier à croissant.

Taylor, p. 95 ; Léotaud, p. 433.

259. Nycticorax nycticorax nævius (*Bodd.*).—Black-crowned Night Heron. Crabier batali.

Nycticorax nævius Léotaud, p. 431.

260. Ardea cyanura (*Vieill.*).—Tchogue. Quioc.

Butorides virescens Taylor, p. 95.
Ardea grisea Léotaud, p. 421.

Common. In habits this bird resembles *Ardea virescens*, but its notes are easily distinguishable from those of that species.

261. Ardea cærulea *Linn.* — Little Blue Heron. Aigrette bleue.

Taylor, p. 95 ; Léotaud, p. 410.

Common at the mouth of the Caroni River.

262. Ardea tricolor ruficollis (*Gosse*). — LOUISIANA HERON. AIGRETTE À VENTRE BLANC.

Ardea leucogaster LÉOTAUD, p. 424.

263. Ardea agami *Linn.*—AGAMI. BLONGIOS.

LÉOTAUD, p. 412.

264. Ardea candidissima *Gmel.* — SNOWY HERON. AIGRETTE À PANACHE.

LÉOTAUD, p. 408.

265. Ardea egretta *Gmel.* — WHITE EGRET. GRANDE AIGRETTE.

LÉOTAUD, p. 406.

Common at the mouth of the Caroni River, where, while fishing, they marked the limit of shoal water.

266. Ardea herodias *Linn.* — GREAT BLUE HERON. AILERONNE À CALOTTE BLANCHE.

LÉOTAUD, p. 404.

Léotaud remarks that he had seen only one example of this bird, probably the one now preserved in the Victoria Institute. This is a nearly adult specimen of *A. herodias*, and measures: wing, 18.75; tarsus, 7.12; exposed culmen, 5.00 in.

267. Ardea cocoi *Linn.*—AILERONNE.

LÉOTAUD, p. 401.

268. Ardetta involucris (*Vieill.*)—QUIOC JAUNE RAYÉ.

Ardea variegata LÉOTAUD, p. 419.

269. Ardetta exilis (*Gm.*).—LEAST BITTERN. QUIOC JAUNE.

Ardea exilis LÉOTAUD, p. 415.

270. Botaurus pinnatus (*Wagl.*).—BITTERN. BUTOR.

LÉOTAUD, p. 429.

271. **Tigrisoma brasiliensis** (*L.*).—Rush Crabier. Crabier jonc.
Léotaud, p. 426.

272. **Cancroma cochlearia** *Linn.*—Boat-bill. Crabier bec plat.
Léotaud, p. 436.

273. **Tantalus loculator** *Linn.*—Wood Ibis. Soldat.
Léotaud, p. 438.

274. **Guara rubra** (*L.*).—Scarlet Ibis. Flamant.
Ibis rubra Léotaud, p. 440.

275. **Ajaja ajaja** (*L.*).—Roseate Spoonbill. Spatule.
Platalea ajaja Léotaud, p. 438.

276. **Palamedea cornuta** *Linn.*—Kamichi. Horned Screamer. Codinne-bois.
Léotaud, p. 488.

277. **Cairina moschata** (*L.*).—Muscovy Duck. Canard-pays.
Léotaud, p. 521.

278. **Dendrocygna discolor** *Scl. & Salv.*—Whistling Duck. Ouikiki ailes blanches.
Dendrocygna autumnalis Léotaud, p. 507.

279. **Dendrocygna viduata** (*L.*).—Tree-duck. Ouikiki bouriki.
Léotaud, p. 509.

280. **Dendrocygna fulva** (*Gm.*).—Fulvous Tree-duck. Ouikiki ailes rouges.
Anas bicolor Léotaud, p. 514.

281. **Erismatura dominica** (*L.*).—Squat-duck. Vingeon.
Léotaud, p. 525.

282. Aythya affinis (*Eyt.*). — LESSER SCAUP. CANARD FRANCE.

Fuligula marila LÉOTAUD, p. 522.

283. Spatula clypeata *Linn.*—SHOVELLER. CANARD SPATULE.

LÉOTAUD, p. 518.

284. Anas discors *Linn.* — BLUE-WINGED TEAL. SARCELLE À CROISSANTS.

Pterocyanea discors LÉOTAUD, p. 516.

285. Anas americana *Gmel.* — AMERICAN WIDGEON. VINGEON.

Mareca americana LÉOTAUD, p. 511.

286. Fregata aquila (*L.*).—MAN-'O-WAR BIRD. FRÉGATE.

TAYLOR, p. 96; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Atagen aquila LÉOTAUD, p. 556.

Common in the Gulf of Paria. A small tree-grown rock at the entrance to the first Boca has for many years been famous as a roosting place for these birds. At the time of my visit about two hundred birds were perched upon the whitened trees. They were apparently all immature birds with white heads and breasts.

287. Pelecanus fuscus *Linn.*—BROWN PELICAN. GRAND-GOSIER.

TAYLOR, p. 96; LÉOTAUD, p. 552; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.

A common bird in the Gulf of Paria.

288. Phalacrocorax brasiliensis (*Gm.*). — CORMORANT. PLONGEON À BEC CROCHU.

Graculus carbo? LÉOTAUD, p. 525.

289. Anhinga anhinga (*L.*).—ANHINGA. PLONGEON-SOIE.

Plotus anhinga LÉOTAUD, p. 548.

290. Sula leucogastra (*Bodd.*). — BLACK-AND-WHITE BOOBY. FOU COMMUN.

RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Sula parva LÉOTAUD, p. 551.

291. Sula piscator (*L.*)—WHITE BOOBY. FOU À PATTES ROUGES.

LÉOTAUD, p. 551 ; RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.

292. Rhynchops nigra *Linn.*—BLACK SKIMMER. BEC-EN-CISEAUX.

LÉOTAUD, p. 534.

293. Anous stolidus (*L.*).—NODDY. MAUVE NOIRE.

Anous melanogenys LÉOTAUD, p. 547.

294. Sterna antillarum (*Less.*).—LEAST TERN. PETITE MAUVE.

Sterna argentea LÉOTAUD, p. 545.

295. Sterna dougalli *Montag.*—ROSEATE TERN. MAUVE À BEC NOIR.

Sterna paradisea LÉOTAUD, p. 539.

296. Sterna eurygnatha *Saunders.*—BLACK-LEGGED TERN. GRANDE MAUVE À PATTES NOIRES.

SAUNDERS P. Z. S. 1876, p. 655.
Sterna elegans LÉOTAUD, p. 542.

297. Sterna maxima *Bodd.*—ROYAL TERN. MAUVE À QUEUE BLANCHE.

RIDGW. Proc. U. S. N. M. VII, 1884, p. 173.
Sterna cayennensis LÉOTAUD, p. 535.
Sterna regia, *ibid*, p. 543.

Several were observed at La Brea.

298. Phaethusa magnirostris (*Licht.*).—YELLOW-FOOTED TERN. MAUVE À PATTE JAUNE SOUFRE.

Sterna chlorispoda LÉOTAUD, p. 537.

A bird of this species passed within gunshot of me at the mouth of the Caroni River, but was not secured.

299. Geochelidon nilotica (*Hasselq.*).—MARSH TERN. MAUVE À DOS CENDRÉ.

Sterna aranea LÉOTAUD, p. 540.

300. Larus atricilla *Linn.*—LAUGHING GULL. PIGEON DE MER.

Larus ridibundus LÉOTAUD, p. 532.

301. Podilymbus podiceps (*L.*). — PIED-BILLED GREBE. PLONGEON.

Podilymbus carolinensis LÉOTAUD, 529.

302. Colymbus dominicus *Linn.*—SAN DOMINGO GREBE. PETIT PLONGEON.

Podiceps dominicus LÉOTAUD, p. 528.

303. Crypturus pileatus (*Bodd.*).—QUAIL. CAILLE.

Tinamus sovi LÉOTAUD, p. 385.

A very common bird, frequenting the borders of the forests, and occasionally found far in the woods. It is preëminently a ground bird, and, like a Rail, seeks safety by running through the dense undergrowth. Only once did I startle one into flying—a short, whirring flight of a few yards.

Their call is a liquid, plaintive, trilling whistle of three to five seconds duration, and uttered at intervals of half a minute to a minute. Rarely, however, it is given more rapidly, and whistle succeeds whistle with increasing volume until the limit of the performer's vocal powers is reached. I did not observe the birds while uttering this latter call, due, perhaps, to some unusual excitement, but when whistling under ordinary conditions they did not assume an unusual position, but, stopping, raised their head and trilled their musical call.

They are rather curious, unsuspicious birds, and an imitation of their notes would sometimes bring them to within a few feet of me, where they would remain some minutes, evidently looking for the unseen caller. It was unusual, except in rainy or cloudy weather, to hear them calling during the day, but just before sunrise and just after sunset they could be heard in numbers.

The following species, given by Léotaud, I am unable to identify.

304. **Polytmus mellisugus.**—Saphir-savanne.

Léotaud, p. 138.

Specimen not in Léotaud's Collection.

305. **Columba caribæa** *L.*?

Léotaud, p. 558.

306. **Nyroca leucopthalma.**—Canard zié-gris.

Léotaud, p. 524.

Article II.—STUDIES OF SOME SPECIES OF NORTH AMERICAN ÆGERIIDÆ.

By William Beutenmüller.

In advance of a monographic revision of the family Ægeriidæ of America north of Mexico, I herewith offer the following notes upon material chiefly contained in the Hy. Edwards Collection in the American Museum of Natural History. I have also appended translations of the descriptions of the species described by Boisduval, with the hope that these may be re-discovered. I have been unable to conclusively recognize any of Boisduval's species amongst the material accessible to me. In the whole of the Ægeriidæ the specific differences are very slight, though constant in most of the species, but it requires considerable attention and the careful comparison of species to distinguish one from the other. At first sight a box of these creatures would appear to be a number of individuals differing only in size, with here and there a slight change in the coloration. To the naked eye they present no more differences than a collection of Eleodes or Ichneumons. Another difficulty surrounding this group is that the larvæ feed within the stems of plants, and thus are not easy of access, while the work of raising them through their various stages becomes a task of no mean importance; moreover, the perfect insects are rarely found, and several years must elapse before the species of his own district comes into the hands of a collector. They also soon loose their scales through flight, and when pinned become covered with grease, and thus important characters are often lost; consequently considerable attention must be paid to the condition of the specimen before describing it.

Vespamima sequoiæ (*Hy. Edwards*).

Bembecia sequoiæ Hy. Edwards, Papilio, I, 1881, p. 181.
Bembecia superba Hy. Edwards, Papilio, I, 1881, p. 181.

Bembecia superba was described from a somewhat worn example, and it is identical with *Bembecia sequoiæ*. It is not a *Bembecia* but the type of an apparently new genus. It differs from *Bembecia* by having longer antennæ thickened at the apex, while those of *Bembecia* are tapering. The antennæ of the male have minute pectinations, while in *Bembecia* they are plumose. It also differs in venation and cut of the wings. The wings of *Bembecia*, especially the hind wing, are elongate with the hind angle much produced, while in the other genus the hind wings are more rounded. I propose the name *Vespamima* for this new genus.

Types: *B. sequoiæ.* Two males and two females from Mendocino Co., California. Coll. Hy. Edwards, Am. Mus. Nat. Hist. *B. superba.* One female, from Washington State. Coll. E. L. Graef.

Tirista admirandus (*Hy. Edwards*).

Sciapteron admirandus HY. EDWARDS, Papilio, II, 1882, p. 54.

This species it appears to me would be better placed in the genus *Tirista* of Walker (Cat. Br. Mus., pt. XXXI, 1864, p. 22). It differs from *Sciapteron* by the long plumose pectinations of the antennæ.

Type: One male, from Texas. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Podosesia fraxini (*Lugger*).

Ægeria fraxini LUGGER (MS.) ORCUTT and ALDRICH, Bull. Agricul. Exp. Station, S. Dakota, March, 1891.
Trochilium fraxini LUGGER, Psyche, VI, 1891, p. 109, pl. iii, fig. 4.

This species does not belong to the genus *Trochilium*, but it appears to be more properly placed in the genus *Podosesia*. The venation is the same, and the cut of the wings and shape of the body are also similar. It only differs by having the antennæ minutely bipectinated. In coloration it differs from *P. syringæ* by the yellow bands on the first, second and third segments, and the other segments wholly yellow, as is also the underside of the body, while the body of *syringæ* is entirely brown above and below. The fore wings are light yellowish brown, dark brown in *syringæ*. The legs are yellow with only traces of a darker shade, while in *syringæ* they are distinctly black and yellow.

The hind wings are also paler in *fraxini*. One male from Miles City, Montana. Coll. Am. Mus. Nat. Hist. Presented by Mr. H. G. Dyar.

Parharmonia fraxini (*Hy. Edwards*).

Carmenta fraxini Hy. Edwards, Papilio, I, 1881, p. 185.
Harmonia morrisoni Hy. Edwards, Papilio, II, 1882, p. 54.

The genus *Harmonia* erected by Hy. Edwards is preoccupied in Coleoptera, having been established in 1846 by Mulsant for a genus in the Coccinellidæ. It therefore must be changed, and I propose for it the name *Parharmonia*.

Harmonia morrisoni Hy. Edw. is the same as *Carmenta fraxini* Hy. Edw., but the latter belongs to the genus *Parharmonia* and not to *Carmenta*.

Types: Male and female, Coll. Hy. Edwards, Am. Mus. Nat. Hist.; one male, Coll. C. V. Riley, Washington, D. C.

Habitat: New York, New Jersey, Washington, D. C., Missouri, Montana.

Parharmonia græfi (*Hy. Edwards*).

Sciapteron græfi Hy. Edwards, Papilio, I, 1881, p. 183.

This species does not belong to the genus *Sciapteron* but to *Parharmonia*.

Types: Coll. Hy. Edwards, Am. Mus. Nat. Hist. and Coll. E. L. Graef.

Habitat: Nevada.

Albuna pyramidalis (*Walker*).

Ægeria pyramidalis Walker, Cat. Lepid. B. Mus. pt. VIII, 1856, p. 40; Hy. Edwards, Papilio, I, 1891, p. 206.
Albuna vancouverensis Hy. Edwards, Papilio, I, 1881, p. 188; Grote's New Check List Moths, 1882, p. 12.

Albuna vancouverensis Hy. Edw. is the same as *Albuna pyramidalis* (Walker). The moth is black with a yellow band on the posterior edge of each abdominal segment. The fore wings have broad black borders with red along the inner margin; the outside of the transverse band is also narrowly edged with red as well as the inner side of the outer margin. The legs are black with yellow bands. *Albuna tanaceti* (=*Albuna montana*) and *Albuna torva* (=*Albuna coloradensis*) can be considered as nothing more than varieties or climatic forms of *Albuna pyramidalis*. *Albuna rubescens* is also a variety.

Habitat: Adirondack Mts., New York (Coll. E. L. Graef); Ontario, Canada; Colorado; N. W. Territory, Canada; Summit Sierra Nevada, California; Banff, B. C.; Mt. Hood, Oregon; Nevada; Vancouver Island. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Albuna pyramidalis var. **montana** (*Hy. Edwards*).

Albuna montana Hy. Edwards, Papilio, I, 1881, p. 188; Grote's New Check List Moths, 1882, p. 12.
Albuna tanaceti Hy. Edwards, Papilio, I, 1881, p. 188.

This form differs from *pyramidalis* by having the yellow on the legs predominating and banded with black. The red on the primaries is also somewhat more distinct; otherwise it is the same as *pyramidalis*.

Habitat: Nova Scotia; Colorado; Sierra Nevada, Cal.; Vancouver Island (Coll. Hy. Edwards, Am. Mus. Nat. Hist.); Montreal, Canada (Coll. H. H. Lyman); White Mts., New Hampshire; Nevada; Anticosti Island (Coll. F. Tepper, Agricul. Coll., Michigan).

Albuna pyramidalis var. **rubescens** (*Hulst*).

Sesia rubescens Hulst, Bull. Brooklyn Ent. Soc. III, 1881, p. 76.

May be distinguished from the preceding form by having the red on the primaries quite distinct and considerably heavier. The legs are wholly yellow and of a deeper shade than in *montana*, and the abdominal bands are also darker.

Three females from Colorado (including the type). Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Albuna pyramidalis var. **coloradensis** (*Hy. Edwards*).

Albuna coloradensis Hy. Edwards, Papilio, I, 1881, p. 189; Grote's New Check List Moths, 1882, p. 12.
Albuna torva Hy. Edwards, Papilio, I, 1881, p. 189.

In this form the legs and body are wholly black without any traces of yellow markings whatever. The wings have the borders black without any traces of red as in the preceding forms, except a very slight indication of this color along the inner margin of the primaries.

Habitat: White Mts., N. H. (Coll. Mrs. A. T. Slosson); White Mts., N. H., and Anticosti Island (Coll. F. Tepper, Agricul. College, Michigan); Colorado, Vancouver Island and N. W. Territory, Canada (Coll. Hy. Edwards, Am. Mus. Nat. Hist.); Montreal, Canada (Coll. H. H. Lyman).

Ægeria lupini *Hy. Edwards.*

Ægeria lupini Hy. Edwards, Papilio, I, 1881, p. 192; Wm. Beutenmüller, Bull. Am. Mus. Nat. Hist. IV, 1893, p. 24.
Ægeria perplexa Hy. Edwards, Papilio, I, 1881, p. 192.
Ægeria impropria Hy. Edwards, Papilio, I, 1881, p. 193.
Ægeria washingtonia Hy. Edwards, Papilio, I, 1881, p. 197.
Ægeria madariæ Hy. Edwards, Papilio, I, 1882, p. 201; Wm. Beutenmüller, Bull. Am. Mus. Nat. Hist. IV, 1893, p. 24.

In the Museum Bulletin, Vol. V, page 24, I united *Ægeria madariæ* with *Æ. lupini.* Since then close studies have been made of *Æ. perplexa*, *Æ. impropria*, and *Æ. washingtonia*, and I find that these do not differ from *Æ. lupini.* The species were described from specimens with the scales more or less abraded through flight and age. *Æ. perplexa* is a small male.

Types: *Æ. lupini*, *Æ. madariæ*, *Æ. washingtonia* and *Æ. impropria.* Coll. Hy. Edwards, Am. Mus. Nat. Hist. *Æ. perplexa.* Coll. B. Neumoegen; one authentic male. Coll. E. L. Graef.

Habitat: Washington, California, Nevada, Texas and Nova Scotia.

Ægeria saxifragæ *Hy. Edwards.*

Ægeria saxifragæ Hy. Edwards, Papilio, I, 1881, p. 190.
Ægeria henshawi Hy. Edwards, Papilio, II, 1882, p. 56.

Ægeria henshawi was described from a worn specimen, and is the same as *Æ. saxifragæ.*

Types: *Æ. saxifragæ*, one female from Colorado; *Æ. henshawi*, one female from Mingan Island, Labrador. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Ægeria albicornis *Hy. Edwards.*

Ægeria albicornis Hy. Edwards, Papilio, I, 1881, p. 201.
Ægeria proxima Hy. Edwards, Papilio, I, 1881, p. 201.

This species has been reared from larvæ found under the bark of *Salix californica* (Proc. Ent. Soc. Wash., Vol. I, p. 85). I have also bred it from the trunks of young willows infested with larvæ of *Cryptorhynchus lapathi.* The male was described by Mr. Edwards as *Æ. proxima.* Judging from the description, I also consider *Albuna modesta* Kellicott the same as *Æ. albicornis.* It occurs from the Atlantic to the Pacific Coast. At present it is known from New York, New Jersey, White Mts., New Hampshire, Connecticut, Colorado, Nevada and California.

Types: *Æ. albicornis*, two females. Coll. Hy. Edwards, Am. Mus. Nat. Hist., and Coll. F. Tepper, Agricul. College, Michigan.

Ægeria lustrans (*Grote*).

Trochilium lustrans Grote, Can. Ent. XII, 1880, p. 213.
Ægeria lustrans Beutenmüller, Bull. Am. Mus. Nat. Hist. V, 1893, p. 25.
Ægeria bollii Hy. Edwards, Papilio, I, 1881, p. 191.

Ægeria bollii was described from a single male example from Texas, and it is identical with *Ægeria lustrans.*

Type: *Æ. lustrans.* Coll. Hy. Edwards, Am. Mus. Nat. Hist. *Æ. bollii*, one example, Coll. E. L. Graef.

Ægeria edwardsii, sp. nov.

Head and antennæ black; palpi white, black outside; coxæ of fore legs white, middle and hind legs deep brown; tibiæ pale yellow with a black band. Thorax blackish brown with traces of a very narrow stripe along the patagiæ. Body deep brown with a very slight purplish reflection, second segment and posterior edge of last segment with a narrow yellow band; fourth segment yellow. Underside with four pale yellow bands, one on the first and one on each of the last three segments. Anal tuft black with two small bunches of yellow scales above. Fore wings deep brown, with a slight purplish reflection with only a few short streaks of yellow before and after the indistinct discal spot. Hind wings with brown veins, outer border and scales brown; space between the veins pale orange; discal spot black. Underside of fore wings pale orange at base and the yellow streaks beyond the discal mark forming a spot. Hind wings same as above. Expanse, 20 mm.

One female, Denver, Colorado. Collected by Mr. D. Bruce. Type: Coll. Am. Mus. Nat. Hist.

Allied to *Ægeria verecunda* Hy. Edwards, but differs from it in the color of the wings and in other particulars. Named in honor of the late Hy. Edwards, who has contributed much to the knowledge of the North American Ægeriidæ.

Ægeria deceptiva, sp. nov.

Head and antennæ black; collar dull yellow; palpi yellow inside, black outside, as is also the last joint. Thorax black with traces of a yellow stripe on the patagia and a yellow mark on the posterior end. Body black with four distinct yellow bands; one on the posterior edge of each of the second and fourth segments, and two which occupy almost the whole of the last two segments. There are also faint traces of a band on the first, third and fifth segments; body beneath wholly yellow. Anal tuft above black at the sides and yellow in the middle and beneath. Thorax beneath black with a yellow spot on each side. Legs yellow banded with black. Fore wings transparent with narrow black borders and a transverse mark at the end of the cell of the same color. Hind wing also with narrow black border. Beneath the wings have the borders dull orange and the outer borders black. The transverse band dull orange in middle. Expanse, 25 mm.

Type: One male, from Colorado, Coll. Am. Mus. Nat. Hist. Collected and presented by Mr. David Bruce. The species is allied to *Æ. senecioides* Hy. Edw.

Ægeria culiciformis (*Linn.*).

Wings transparent, with a metallic blue margin, and the fore wings with a bar of the same color across and beyond the middle. Body blue black with an orange red band across the middle, above and below, and which is connected with a narrow stripe of the same color at the sides, running to the base of the body; palpi orange red; legs blue black; tarsi light orange. Thorax blue black with an orange spot on each side of the anterior part beneath. Underside of fore wings orange red along the costa. Antennæ black. Expanse, 23 mm.

A single male of this European species is in the collection of Mr. Charles Palm, collected by Mr. C. Weidt in the Cascade Mountains, British Columbia. This is the first record of its occurrence in this country.

Ægeria rutilans (*Hy. Edwards*).

Albuna rutilans Hy. Edwards, Papilio, I, 1881, p. 186.
Ægeria aureola Hy. Edwards, Papilio, I, 1881, p. 194.
Ægeria hemizoniæ Hy. Edwards, Papilio, I, 1881, p. 198.

There are no differences between *Albuna rutilans* and *Ægeria hemizoniæ* to warrant their separation as distinct species. The latter was described from three worn examples. *Ægeria aureola* I consider only a small female of *rutilans*. The insect is more properly referred to *Ægeria* than to *Albuna*.

Types: Six females from Nevada and California. Coll. Hy. Edwards, Am. Mus. Nat. Hist. *Æ. aureola.* Coll. E. L. Graef.

Ægeria scitula *Harris.*

Ægeria scitula Harris, Am. Journ. Sc. and Arts, XXXVI, 1838, p. 313; Walker, Cat. B. Mus. pt. VIII, 1856, p. 45; Morris, Synop. Lepid. N. Am. 1862, p. 141; Boisduval, Suites à Buffon, Nat. Hist. Lépid. 1874, p. 439.
Trochilium hospes Walsh, Proc. Ent. Soc. Phil. VI, 1866, p. 270; Packard, Fifth Rep. U. S. Ent. Comm. 1890, pp. 217, 270 and 296.
Trochilium gallivora Westwood, Gardener's Chronicle, 1854, p. 757; Proc. Ent. Soc. London (2) III, 1854, p. 21; Kellicott, Can. Ent. XXIV, 1892, p. 45.

The type of *Ægeria scitula* in the Boston Society of Natural History was examined by me. It agrees in all particulars with an example bred by me from a larva found under the bark of chestnut, and a specimen bred by Rev. J. L. Zabriskie from the gall of *Andricus cornigerus* on oak (*Quercus palustris*). The specimens before me also agree with Walsh's description of *Trochilium hospes*, which was bred from a gall on willow; I also consider *Trochilium gallivora* identical with *Ægeria scitula*.

Ægeria rubristigma *Kellicott.*

Ægeria rubristigma Kellicott, Can. Ent. XXIV, Sept. 1892, p. 211; Insect Life, V, Nov. 1892, p. 84.
Ægeria asiliformis Hy. Edwards, Papilio, II, 1882, p. 56.

The examples recorded from Massachusetts by the late Hy. Edwards as being identical with the European *Ægeria asiliformis* Rott, are a distinct species, and they fairly agree with the description of *Ægeria rubristigma*. A comparison of specimens of the two, however, is necessary to definitely decide this question. *Æ. rubristigma* was bred by Mr. Kellicott from a gall found on oak (*Quercus palustris*), and the so-called examples of *Æ. asiliformis* were bred from willow.

Pyrrhotænia polygoni *Hy. Edwards.*

Pyrrhotænia polygoni HY. EDWARDS, Papilio, I, 1881, p. 202.
Pyrrhotænia meadii HY. EDWARDS, Papilio, I, 1881, p. 204.

The female of this species was erroneously described as a male. *P. meadii* is the male of *P. polygoni*.

Types: Two males, Lake Tahoe, California, and one female, San Miguel, California. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Pyrrhotænia fragariæ *Hy. Edwards.*

Pyrrhotænia fragariæ HY. EDWARDS, Papilio, I, 1881, p. 202; BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist. V, 1893, p. 26.
Pyrrhotænia helianthi HY. EDWARDS, Papilio, I, 1881, p. 203; BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist. V, 1893, p. 26.
Pyrrhotænia orthocarpi HY. EDWARDS, Papilio, I, 1881, p. 204.

In the Museum Bulletin, Vol. V, p. 26, I united *P. helianthi* with *P. fragariæ*. Since then I have come to the conclusion that *P. orthocarpi* is also a synonym of this species. *P. helianthi* and *P. fragaria* are the female and *P. orthocarpi* the male.

Types: *P. orthocarpi*, three males and one female from Nevada; *P. fragariæ*, one female from Colorado. Coll. Hy. Edwards, Am. Mus. Nat. Hist.

Carmenta nigra, sp. nov.

Head and antennæ black; face and collar and underside of palpi sordid white; thorax and body black, the latter with three white bands on the posterior edge of the second, fourth and last segments; the middle band encircles the body while the other two are only present on the upper side; anal tuft black. Legs black with traces of whitish scales, especially on the anterior coxæ. Fore wings black, opaque, except a few short white streaks beyond the middle and a short white streak before the middle, thus giving rise to a black discal spot. Hind wings black, opaque. Expanse, 15 mm.

Type: One female from Utah. Coll. Chas. Palm.

Translations of Species Described by Boisduval.

Sesia mellinipennis *Boisduval.*

Sesia mellinipennis Boisduval, Species Général, 1874, pl. xiv, 10 B. fig. 12; Suites à Buffon, Nat. Hist. Lépid. p. 402.

Head and antennæ black; palpi yellow; breast marked on each side with a yellow spot; posterior legs banded with black. Thorax black, with a ray on each and the collar yellow. Abdomen, blue black with five yellow rings of which two, on the first and second segments, are interrupted and the three others are situated at the extremity. Anal tuft yellow, middle black. Upper wings transparent with the borders and the transverse spot pale brownish black. Besides the transverse band is marked with a little red in its middle. Hind wings transparent with the veins and border pale brown.

It is a third larger than *cynipiformis*.

Habitat: North America. 2 ♂ ♂, which have been destroyed with several other American species by the powder explosion of the Luxemburg.

Sesia chrysidipennis *Boisduval.*

Sesia chrysidipennis Boisduval, Lépid. California, 1869, p. 64; Suites à Buffon, Nat. Hist. Lépid. 1874, p. 403.

Head and antennæ black; palpi yellow white, brown above; collar straw yellow; corslet black; abdomen deep black with six yellow rings. The anal tuft black with the middle yellow. Thorax on each side with a yellow spot. Feet yellow; knees black. The wings are transparent with the internal border and apical nervures rusty buff; the costa brown; transverse band reddish buff on sides, brown in middle. Hind wings transparent; anterior border a little rusty; outer border, nervures and subcostal spot blackish brown.

It has the form of the European *S. uroceripennis*.

Habitat: Los Angeles, California.

Sesia anthracipennis *Boisduval.*

Sesia anthracipennis BOISDUVAL, Suites à Buffon, Nat. Hist. Lépid. 1874, p. 392.

Head and antennæ black; palpi yellow below with the last joint black on top. Breast of a brownish black; legs brown black. Body of a burnt brown with four yellow rings; anal tuft black, barely mixed with a few yellow hairs on the sides. Wings brown, marked with a small orange point on the space where the second spot is found transparent in most of the species. Hind wings transparent with a large border; the veins and subcostal lunule deep black.

Has the size and build of a very small *asiliformis.*

Georgia. Lives on a species of *Salix.*

Sesia bibionipennis *Boisduval.*

Sesia bibionipennis BOISDUVAL, Lépid. California, 1869, p. 64; Suites à Buffon, Nat. Hist. Lépid. 1874, p. 421.

Head and antennæ black; palpi grayish white below, black above. Corslet black. Feet brownish, limbs reddish brown (russet). Abdomen black with two rings of yellowish white. Anal tuft black mixed with a few yellow hairs and preceded in the male by a little white ring. Upper wings with two transparent spots, of which the anterior arrow-shaped, and the posterior round and divided into fine rays by the nervures. Hind wings transparent, nervures border and subcostal lunule black.

General appearance and size of *tenthreniformis* and near *S. bibioniformis* of Europe.

Habitat: California.

Sesia xiphiæformis *Boisduval.*

Sesia xiphiæformis BOISDUVAL, Suites à Buffon, Nat. Hist. Lépid. 1874, p. 409.

Head and antennæ bluish black; eyes reddish brown; palpi and feet black. Abdomen bluish black marked in the middle with a wide orange or rather two rings united, of a reddish buff. The anal tuft black, preceded in the male with a longitudinal buff dash, which does not reach the extremity of the brush. The upper wings entirely blackish brown with a fringe of light brown. Hind wings transparent with borders and nervures black. Also the anterior border is largely deep black. Expanse, 35 to 38 mm.

This large and beautiful *Sesia* differs a little from our European species. It is the type of a little group near *myopæformis* and *culiciformis*.

Habitat : United States.

Sesia nomadæpennis *Boisduval.*

Sesia nomadæpennis BOISDUVAL, Lépid. California, 1869, p. 63 ; Suites à Buffon, Nat. Hist. Lépid. 1874, p. 399.

Head black ; collar and palpi yellow. Corslet bluish black. Abdomen also bluish black with three yellow rings. The upper wings transparent with the nervures, borders, extremity and transverse band deep black. The internal border is tinted with ferruginous, and the apical extremity rayed with a little buff. The small transverse spot externally with a little ferruginous. Hind wings transparent, nervures, border and subcostal spot black.

It has the size of the European *S. conopiformis* (*nomadiformis*).

Habitat : California.

Article III.—NOTES ON MAMMALS FROM NEW BRUNSWICK, WITH DESCRIPTION OF A NEW SPECIES OF EVOTOMYS.

By J. A. Allen.

The present paper is based on a collection of about 175 specimens, representing 21 species. The collection is one of the results of an expedition sent out by the Museum to New Brunswick, primarily for the purpose of securing proper accessories for a 'Moose Group,' now in process of preparation, the other results of the enterprise being incidental to the main purpose. The expedition was in charge of Mr. John Rowley, Jr., Chief of the Department of Taxidermy, who was accompanied by his brother, Mr. Charles P. Rowley, as a volunteer assistant. Mr. E. T. Adney also accompanied the party, rendering material aid and contributing to the success of the expedition.

About six weeks were spent in the field (Sept. 15 to Nov. 1, 1893), in the Tobique River region of New Brunswick. The area traversed extended from Andover, on the St. Johns River, to the Fork of the Tobique River, and thence to Trousers Lake,[1] a distance of about seventy-five miles.

The district is strictly Canadian, as shown by both the mammals and the birds obtained, among the latter being such forms as *Parus hudsonicus*, *Perisoreus canadensis*, *Loxia leucoptera*, *Picoides arcticus*, *Dendragopus canadensis*, and *Bonasa umbellus togatus*, of most of which good series were collected. The forest is wholly second-growth, the original growth having been long since removed by lumbermen.

While the number of species of mammals actually taken on the expedition is only 21, Mr. John Rowley, to whom I am indebted for all of the field notes given in the following list, has kindly furnished me with interesting information respecting a number of other species, which it has been thought best to place on record in the present connection. His notes are distinguished by being inclosed in marks of quotation, and followed by the initial "R."

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[1] This lake is said to have received its name from its resemblance in outline to a pair of trousers.

1. **Cariacus virginianus** (*Bodd.*). Virginia Deer.—"Not common in the region of Trousers Lake, but found chiefly lower down the river, near clearings."—R.

2. **Alces machlis** (*Linn.*). Moose.—A fine old bull was killed by Mr. Rowley, for the Museum 'Moose Group,' at Gulquac Lake. A skeleton of another old male was also obtained, for which the Museum is indebted to the Hon. John Costigan of Ottawa.

"Moose were of frequent occurrence in the Trousers Lake region, having considerably increased during the last ten years, in consequence of legal protection."—R.

3. **Rangifer tarandus caribou** (*Kerr*). Woodland Caribou.—"Common everywhere, being found as far down the St. Johns River as Woodstock."—R.

4. **Vespertilio gryphus** *F. Cuvier.* Brown Bat.—One specimen, Trousers Lake, Sept. 28. Others were seen.

I follow Dr. Harrison Allen (Mon. N. Am. Bats, 1893 (March, 1894), p. 75) in discarding the name *Vespertilio subulatus* Say, so long in use for this species, as indeterminable, and in any case inapplicable to the present species.

5. **Blarina talpoides** (*Gapper*).[1] Short-tailed Shrew.—One specimen, Andover, Oct. 28.

6. **Sorex forsteri** *Rich.* Forster's Shrew.—A series of 11 specimens is provisionally referred to this species, with the original description of which they seem sufficiently to agree. The average of the measurements taken from the fresh specimens by the collector is as follows: Total length, 99.5 mm. (3.92 in.); head and body, 70 mm. (2.75 in.); tail, 45 mm. (1.77 in.); hind foot, 12.5 mm. (.50 in.).

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[1] On the proper name and relations of this species, *cf.* Miller, Proc. Boston Soc. Nat. Hist., XXVI, p. 185, March, 1894.

"Apparently common everywhere, in all sorts of situations."—R.

7. **Scalops aquaticus** (*Linn.*). COMMON MOLE.—"A mole, probably of this species, was evidently common about the settlements. No specimens were taken, but from the descriptions obtained of it, it was not the Star-nosed Mole (*Condylura cristata*)."—R.

8. **Lepus americanus** *Erxl.* VARYING HARE.—This species is represented by 5 specimens taken Oct. 27 and 30, by 9 specimens taken Nov. 14–18, and by 15 specimens taken at various dates from Nov. 24 to Dec. 14, all at or near Andover. All, except the five first mentioned, were taken by Mr. A. Lockwood, after the return of the expedition. The 29 specimens form a series fully illustrating the autumnal change from the brown summer pelage to the white coat of winter. As this series, combined with other material in the Museum Collection, forms the subject of a special paper on the seasonal change of color in this species, to be published later in this volume, it is only necessary to note in the present connection that the specimens in which the character of the summer coat is still well shown present a wide range of variation in coloration—from pale-yellowish brown to deep-reddish brown, more or less strongly varied with black in different individuals.

Mr. Rowley informs me that this Hare is locally common in the region visited, being confined mainly to the cedar swamps.

9. **Erethizon dorsatus** (*Linn.*). CANADA PORCUPINE.—Two specimens, Fork of Tobique, Sept. 20.

10. **Zapus insignis** *Miller.* NORTHERN JUMPING MOUSE.—Three specimens, Tobique River, Sept. 21 and Oct. 9.

"Not an uncommon species in the long grass of the clearings, but they seemed to avoid the traps."—R.

11. **Mus decumanus** *Pallas.* BROWN RAT.—One specimen, Andover, Oct. 29.

12. **Mus musculus** *Linn.* HOUSE MOUSE.—Andover. Several specimens, caught in the fields.

13. **Sitomys americanus canadensis** *Miller.*[1] CANADIAN WHITE-FOOTED MOUSE.—A series of 24 specimens is typically referable to *S. a. canadensis*, now for the first time represented in the Museum Collection. Nearly all are in the plumbeous coat, one only being fully adult. This form, as pointed out by Mr. Miller (l. c.), differs notably from the common White-footed Mouse of southern New England and further south.

"Very common about piles of logs in lumber camps, but also found generally distributed."—R.

14. **Arvicola riparius** *Ord.* MEADOW MOUSE.—Represented by 29 specimens, of which the greater part are immature; two of the adults are very strongly reddish brown.

"All of the specimens taken at Trousers Lake were trapped in the evergreen forests; at the Forks of the Tobique they were found only in the cleared land."—R.

15. **Arvicola chrotorrhinus** *Miller.*[2] RUFOUS-NOSED MEADOW MOUSE.—One specimen, ♀ ad., Trousers Lake, N. B., Oct. 7, 1893.

This specimen has been identified as above by Mr. Miller, who has compared it with the types of his *A. chrotorrhinus* from the White Mountains of New Hampshire, the only other locality from which it is thus far known. Mr. Miller's specimens were taken near the summit of Mt. Washington, N. H., July 12–15, 1893, hence nearly three months before the one above recorded.

"This specimen was taken in a small opening in the spruce woods. Two others were taken, but were so badly mutilated by the traps that they were not saved."—R.

16. **Evotomys gapperi** (*Vig.*). RED-BACKED MOUSE.—Represented by a series of 40 specimens, of which about one-half are adult and the rest in various stages of immaturity. One has a conspicuous patch of white on the back, due to albinism.

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[1] Proc. Biol. Soc. Washington, VIII, 1893, p. 55.

[2] Proc. Boston Soc. Nat. Hist., XXVI, p. 190, March 24, 1894

"This is the common Mouse of the region, being found abundantly everywhere, but perhaps rather more numerously in the spruce woods than in the clearings."—R.

17. **Evotomys fuscodorsalis**, sp. nov.

Smaller than *E. gapperi*, and very differently colored, but similar in proportions. Middle of dorsal region, from crown to base of tail, dusky brown, forming a broad blackish dorsal area; sides light, rather ashy, mouse-gray; below light whitish gray, the hairs dark plumbeous for their basal two-thirds, apically whitish gray. Ears prominent, clothed with short brown hair. Fore feet light gray; hind feet dusky gray. Tail bicolored, above dusky brown, blackish at the extreme tip; lower surface light whitish ashy.

The two specimens measure as follows:[1] ♂, total length, 129 mm. (5.06 in.); head and body, 89 mm. (3.50 in.); tail, 40 mm. (1.56 in.); hind foot, 16.5 mm. (.65 in.); ear from crown, 7.6 mm. (.30 in.); ♀, total length, 127 mm. (5.00 in.); head and body, 90 mm. (3.56 in.); tail, 37 mm. (1.44 in.); hind foot, 18 mm. (.70 in.); ear from crown, 7.6 mm. (.30 in.).

Skull, ♂ ad.—Total length (front border of nasals to occip. cond.), 23.4 mm. (.92 in.); basal length (inner base of incisors to occip. cond.), 20.5 mm. (.81 in.); greatest zygomatic breadth, 12.7 mm. (.50 in.); greatest width of brain-case, 11.7 mm. (.46 in.); least interorbital breadth, 4 mm. (.16 in.); length of nasals, 9.4 mm. (.37 in.); length of anterior palatine foramen, 4.3 mm. (.17 in.); length of crown surface of upper molar series, 8.1 mm. (.22 in.); length of lower jaw (point of incisors to post. edge of cond.), 10.7 mm. (.42 in.); height at coronoid process, 4.3 mm. (.17 in.).

Type, No. $\frac{6653}{5273}$, ♂ ad., Trousers Lake, N. B., Oct. 17, 1893; C. P. and J. Rowley.

This species is based on two specimens, male and female, taken at Trousers Lake, Oct. 17. Although full grown, neither is apparently very old.

In coloration this species strongly resembles the species of *Phenacomys*, to which genus it was presumed to be referable until an examination was made of the skull and dentition, which show that it is clearly referable to *Evotomys*. It therefore does not require comparison with any other species of the genus. The pattern of coloration is the same as in *E. gapperi*, the red color of the back in that species being replaced with blackish brown in *E.*

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[1] Measurements, except of ear, from the fresh specimens, by the collector.

fuscodorsalis. As regards size, *E. gapperi* from the same locality averages considerably larger, 10 adults averaging as follows: Total length, 144 mm. (5.67 in.); head and body, 101 mm. (3.97 in.); tail, 43 mm. (1.70 in.); hind foot, 20.3 mm. (.80 in.).

18. **Fiber zibethicus** (*Linn.*). MUSKRAT.—Trousers Lake and vicinity of Andover, Sept. 28–Oct. 27. A series of 10 specimens.

"Abundant in all suitable localities."—R.

19. **Tamias striatus lysteri** (*Rich.*). NORTHERN CHIPMUNK.—One specimen, Trousers Lake, Oct. 15.

"Common lower down the river, and probably also on the hardwood ridges about Trousers Lake. This, however, was the only one seen, probably owing to the lateness of the season."—R.

20. **Sciurus hudsonius** *Pallas.* RED SQUIRREL.—Represented by a series of 14 specimens, taken at various localities, Sept. 23 to Oct. 17. All are in rather thin pelage, molting from the summer to the winter coat. The black lateral line is more or less distinct in all.

"Common everywhere, sometimes probably a hundred being seen in a single day."—R.

21. **Sciuropterus volucella sabrinus** (*Shaw*). FLYING SQUIRREL.—"More or less common."—R.

22. **Arctomys monax** *Gmel.*—"Not uncommon about the settlements."—R.

23. **Castor canadensis** *Kuhl.* BEAVER.—A fine specimen, now in the mounted collection of the Museum, was taken Oct. 20 on the Tobique River.

"Now becoming scarce. Saw but one fresh beaver dam, but remains of old ones were frequently met with."—R.

24. **Ursus americanus** *Pallas.* BLACK BEAR.—"More plentiful near the settlements than in the forests. We were much annoyed by bears destroying our sable traps."—R.

25. **Procyon lotor** (*Linn.*). RACCOON.—"Quite common. Thirty were taken by Mr. John Costigan of Ottawa, who was trapping here, during the six weeks of our stay in the region."—R.

26. **Lutra hudsonica** (*Lacép.*). OTTER.—"Not uncommon. Many are caught for their fur by trappers."—R.

27 **Mephitis mephitica** (*Shaw*). SKUNK.—"Found at Andover and Riley Brook, but apparently not common."— R.

28. **Lutreola vison** (*Schreber*). MINK.—The collection contains three specimens taken at Trousers Lake.

"Not uncommon."—R.

29. **Putorius erminea** (*Linn.*). ERMINE; WEASEL.—Two specimens, in summer pelage, taken at Trousers Lake, Sept. 30 and Oct. 15.

30. **Mustela pennanti** *Erxl.* BLACK CAT; FISHER.—"Not uncommon. One of the animals forming the chief dependence of the trappers in their pursuit of furs."—R.

31. **Mustela americana** *Turton.* MARTEN; AMERICAN SABLE.—Two specimens, Trousers Lake, Oct. 7 and 10. Both are very richly colored, the breast patch being deep orange ochre.

"This is one of the most abundant of the fur-bearing species."—R.

32. **Vulpes fulvus** (*Desm.*). RED FOX; SILVER FOX.—"Common about the clearings. The 'Silver' or 'Cross' Fox is frequently taken, but the common form is of course much the more abundant."—R.

Mr. Rowley informs me that the Gray Wolf (*Canis lupus griseo-albus*) has been, so far as he could learn from extended inquiries, quite extinct in this region for many years. Even one of the oldest Indian trappers he met had never seen one.

33. **Lynx canadensis** *Raf.* CANADA LYNX.—"Reputed to be not uncommon."—R.

"The Panther (*Felis concolor*) is said to occur, but no satisfactory evidence of its present existence in the region was obtained."—R.

Article IV.—ON THE SEASONAL CHANGE OF COLOR IN THE VARYING HARE (LEPUS AMERICANUS ERXL.).

By J. A. Allen.

Introductory.

Any one at all familiar with the seasonal changes of color in mammals, and also with the periodic shedding and renewal of the pelage, cannot have failed to note the coincidence of the two phenomena. As a rule, particularly among the Rodentia, the change becomes first apparent on the feet and about the nose, extending gradually up the limbs and over the head, and from the base of the tail anteriorly, and from the sides of the body toward the median line. This, perhaps, may be assumed to be the usual method, particularly in the spring molt, but the process is subject to much irregularity, even among individuals of the same species, and it seems to vary somewhat in different groups.[1] Late in spring, usually at the close of the breeding season, the old coat has become worn, faded, and more or less ragged, and the new hair may be seen coming in irregularly in patches, in addition to the more symmetrical method of change already indicated.

The new hair, forming the summer coat, is much shorter and thinner, and usually brighter in color than the coat it replaces. The change from this coat to the winter dress again is generally accomplished more or less insidiously, but apparently in much the same order as in the case of the change from the winter to the summer coat. The summer coat is worn usually for a much shorter period, and fails to show the same amount of wear and fading, so that the transition is generally less marked and abrupt; the new hair comes in gradually, and overtops the short summer coat, which apparently falls out as the new hair becomes more abundant and longer. Only in the case of some more or less radical change in color can the progress of the fall molt be readily traced, as in the Varying Hares, forming the subject of the present article. In these a brown summer pelage is replaced by a white winter coat; and the change is thus so radical that it should seemingly be an easy matter to determine how it is produced. Yet just how the change of color is effected is still to some extent a matter of dispute. While supposed to be largely due to a molt, it sometimes appears to take place so suddenly that it is popularly thought to be due, in some degree at least, to the blanching of the summer hair.

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[1] Thus in the Hares, as will be shown later, it is quite different from what it is in the Squirrels.

Character of the Pelage.

In order to understand fully the remarks that follow, it is necessary to briefly describe the summer and the winter pelage.

Summer Pelage.—The general color of the upper parts, including the limbs externally, varies in different individuals from pale yellowish gray to deep yellowish brown, and even occasionally to reddish brown, more or less varied with blackish, particularly over the middle and posterior part of the back, due in part to most of the hairs being tipped with black, but often mainly to a strong sprinkling of wholly deep black hairs. There is also a broad pectoral band or 'ruff,' varying from two to three inches in breadth, and in color from yellowish gray to deep rusty fawn. The rest of the lower surface, including the chin and throat, a part of the inner side of the hind limbs, and the whole of the ventral surface posterior to the breast, is white, often washed slightly with fulvous or grayish. The ears are brownish, more or less rusty, the extreme edge whitish, particularly on the posterior border, the apical third externally with a submargin of black, expanding towards the tip into a broad blackish subapical spot. Except basally and along the anterior border, the ears are thinly haired throughout. The soles of the feet are generally more or less dusky.

This pelage, considered in detail, consists of two distinct parts—a thick woolly underfur, and a heavy coat of long overhair. The underfur is plumbeous basally, generally for about two-thirds of its length, with the apical third fulvous or tawny, the exact shade varying in different individuals.

The overhair is of two kinds, as regards both pattern of color and structure. It consists principally of particolored hairs, which are plumbeous basally, generally about as far as the plumbeous zone of the underfur, then blackish for about one-half their total length, then passing abruptly into a broad band of fulvous, and then again abruptly into black at the extreme tip. These hairs are extremely attenuated at the base, gradually thicken as they become black, attaining their greatest diameter at and throughout the subapical fulvous zone, and then rapidly taper to a fine-pointed tip. Mingled with these particolored hairs is a greater or less profusion of wholly black, rather longer hairs, of coarser and firmer texture. These hairs vary greatly in abundance in different individuals, and over different parts of the body, being most abundant along the middle and posterior part of the back. They taper slightly towards the base and tip, but are of a much more uniform diameter than are the particolored hairs. They overtop the particolored hairs, thus not only greatly increasing the blackish cast of the dorsal surface, but by their rigidity imparting greater firmness to the surface of the pelage.

During the autumnal change the particolored hairs are the first to fall out; the longer, firmer, wholly black hairs persist later, quite a proportion of them often remaining after the particolored hairs have disappeared, giving a more or less leaden or dingy effect to the otherwise white winter coat. This effect gradually passes away, although a few black hairs can be found in most early December specimens, but they generally wholly disappear by the middle or during the last half of the month, excepting at southern localities.

Winter Pelage.—Generally everywhere white at the surface, except the tips and edges of the ears, and the soles of the feet, although the latter are much lighter in color than in summer.

The winter pelage is, of course, also made up of two kinds of hair—a woolly underfur, rather longer and much more abundant than in summer, and the longer, coarser, firmer overhair. The underfur is colored much as in summer, except that the tips of the longer fibres are pure white, like the overhair. The overhair is almost invariably pure white from base to tip, although the extreme basal portions of some of the hairs are grayish and pass into a horn-gray middle zone. This condition is rare, occurring in comparatively few specimens, and then only in a very small percentage of the hairs making up the long white coat of overhair. The hairs composing the white covering of overhair vary greatly in diameter, not only in different individuals, but in different parts of the body of the same animal, and even from the same region, as from the middle of the back. The coarser hairs have a firm shaft from the tip to the point of insertion into the skin; the finer hairs have only the outer half or two-thirds firm and shaftlike, the lower portion dwindling to a thin filament, and when detached is curly and not unlike one of the coarser fibres of underfur. There is indeed, in some individuals, an almost complete intergradation as regards texture between the coarser overhair and the longer white-tipped filaments of underfur.

Material Examined.

The following observations are based on a series of about 75 specimens, nearly all of which belong to the Museum Collection.[1] The greater part have been collected for the express purpose of this investigation, and include specimens taken through both the autumnal and vernal changes, as well as at other seasons. About thirty were collected near Andover, New Brunswick, during October, November and December (Oct. 27–Dec. 14), 1894, for the purpose of securing a series showing the transition from the brown summer coat to the white dress of winter. A part of this series was obtained by Mr. J. Rowley, Jr., and his associates, on the recent Museum Expedition to New Brunswick (see *antea*, pp. 99 and 101), and the rest were secured later from an Indian hunter through Mr. Rowley's agency. The greater part of the rest of the series is from the vicinity of Rutland, Vermont, taken at various intervals from Oct. 17 to April 15, and for which I am mainly indebted to Mr. W. W. Granger, who has also kindly secured a series, collected at intervals during March and April, to illustrate the spring molt. There are also four specimens from Kittson County, Minn. (Nov. 17–22), collected and presented by Dr. E. A. Mearns.

This material shows that there is considerable individual variation in respect to the exact time of change at the same locality. Thus some of the specimens taken as early as Nov. 17, both at Rutland, Vt., and in New Brunswick, are already quite white, while others taken at the same locality and on the same day show very little change from the summer coat. Most of the specimens taken the last week in November are in nearly full winter dress, but in some the change is much less advanced. March and April specimens also show a wide range of variation in respect to the spring molt, some individuals changing much earlier than others.

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[1] I am indebted to Dr. C. Hart Merriam, of Washington, for the loan of 13 specimens from his own collection, which have proved especially useful in the present connection. Six of them are from the Adirondack region of New York, and seven from Elk River, Minn. The former include specimens taken in summer and autumn, while the latter were taken during the spring molt.

AUTUMNAL CHANGE.

The early stages of the autumnal change are well shown in five New Brunswick specimens taken Oct. 27-30. In two of these only the sides of the nose, the ears and the feet have become white, the white extending, however, on the fore limbs nearly to the body, and on the hind limbs over the inner edge of the leg to the thigh, with a strong admixture of white hairs all around nearly to the knee. Another specimen is similar except that the ears are much less white and the white extends higher on the sides of the nose. The fourth specimen (No. 6737) is more advanced, the whole top of the nose, nearly to the eyes, being quite whitish, while a broad whitish streak extends backward from this whitish frontal area to the base of the ears. On parting the fur an abundance of short white hairs is seen along the sides of the body and across the rump and lower part of the back. A close examination of the light areas on the front and sides of the head shows that the whiteness is due to a new growth of hair, which in places has almost wholly replaced the brown coat, but is generally mixed with it; on parting the adjoining and still superficially unchanged area an abundance of short white hairs is found which have not yet reached the surface. In the fifth specimen (No. 6739) the change is less advanced on the head, but more advanced on the sides and posterior part of the body, which parts are already more or less whitish, particularly on the thighs, where the greater part of the long hairs of the summer coat have fallen out and the white winter coat begins to show, though it is still largely concealed within the underfur. On the right side of the median line, in front of the hips, are several small irregular patches of white, due to the almost entire falling out of the summer pile, although the thick winter pile here developed is still much shorter than the surrounding pelage.

The next set of twelve specimens was taken some two weeks later (Nov. 14–17), yet, through individual variation, they continue by insensible gradations the stages of change, almost to the full winter coat. No. 6788 of this series is even less advanced than Nos. 6737 and 6739, already noticed. Three or four others are so nearly like these two as not to call for special mention. No. 6791 is a little more advanced, and shows beautifully the progress of change on the head. The whole top of the head, from between the base of the ears to a point somewhat in front of the eyes, is apparently unchanged, forming a large crown patch about twice as long as broad, bounded in front by a pure white nose patch, and on the sides by a broad whitish ocular band, leaving on either side below this a broad, nearly unchanged, malar region, extending forward in a point toward the nostril. The hairs forming the white nose patch are still short, though the longer brown hairs of the old coat have entirely disappeared. The transition to the brown crown patch is abrupt, but on parting the hairs at its anterior border the pelage is found to be thickly set with short, pure white hairs that have not yet reached the surface. The tawny pectoral ruff has become considerably whitened by the incoming white hairs, some of which have nearly reached their full length. One or two of the other specimens already mentioned show the pectoral ruff in about the same condition; in others only a few white hairs have appeared, while in still others it remains practically unchanged at the surface, although on separating the pelage white hairs are found beneath the surface.

No. 3240 (Rutland, Vt., Nov. 17) carries the change considerably further. The whole pelage has become more or less whitened, but there is still a sufficient remnant of the summer coat over the dorsal region to give the prevailing tint to the central portion of the back, gradually fading thence laterally till white becomes the prevailing tint at a point quite high up on the sides of the body. The white nose patch extends laterally to the eyes and centrally in a broad point to the middle of the interocular space, while the whole crown is irregularly whitish, small patches where white prevails being mixed with patches of the summer coat, which is one-third to one-half longer than the new winter coat. This results in giving to the whole top of the head the ragged, patchy appearance so often seen in molting animals, and shows at a glance and beyond question that the change of color is due to a replacement of the summer coat by a winter coat of a different color, and that the whiteness of winter is not due to a change of color in the summer coat. The whole dorsal region is thickly set also with white hairs, but few of which have reached the surface, although a considerable part of the long pile of the summer coat has been shed, except over a narrow band along the median line, extending from the loins to the head and widening anteriorly. The sides of the head have still undergone little change.

Another specimen (No. 3242, same date and locality) is a little more advanced, but presents the same general features, including the rough, patchy appearance of the head. There is, however, much less of the summer coat left over the dorsal region. In No. 3241 (same date and locality) the change is nearly complete, only the black hairs of the dorsal region remaining of the summer coat, producing a general grizzled effect.

The New Brunswick specimens furnish a parallel series to those from Vermont, last described. Other specimens of the New Brunswick series taken later (Nov. 20, 24 and 26) present interesting phases of change. No. 6828 (Nov. 20) has a considerable mixture of the summer coat remaining on the crown, cheeks, ears and shoulders, and less (but still enough to produce a grizzled, dingy effect) over much of the dorsal region. No. 6831 (Nov. 26) has a large part of the top of the head still brown, with much brown hair over the shoulders and along the median line of the back, extending as a narrow band from the nape posteriorly for about two-thirds the length of the body, decreasing in width posteriorly and becoming gradually obsolete. No. 6829 (Nov. 24) has the crown almost unchanged, forming a cap of brown hair projecting above the surrounding white pelage; and there is a very slight admixture of the summer coat over the middle of the back. A specimen taken later (No. 6837, Dec. 6) is nearly white throughout, but is slightly tinged with brown hairs on the back, while the head is piebald through the presence of small spots of brown on the white ground. The hind feet, particularly near the base of the toes, are streaked with fawn color on a white ground, while the anterior surface of the fore limbs is mainly deep fawn color. But it does not follow that the fawn-colored pelage of the feet is a remnant of the summer coat, since this is found also in specimens killed in January and March, the series of specimens covering the period from November to March showing that this is an individual peculiarity, different specimens presenting a gradation from white to fawn-colored feet independently of season.

The December series (Nov. 29 to Dec. 15) shows that after the white color is practically assumed it increases in purity, as does the coat in softness and fullness, by the maturing or lengthening of the white overhair and the thickening of the soft underfur. The long black hairs of the summer coat are the last to disappear, being retained, apparently to give firmness and stability to the pelage, till the white overhair of the winter coat is fully developed.

From the foregoing it will be seen that the Varying Hare has an autumnal molt, not unlike that occurring in other mammals, to which alone the change of color is due;[1] and, furthermore, that the change begins and proceeds in the manner, so well known to every one who has given careful attention to the subject, common to other mammals; it beginning with the nose, feet and ears, extending gradually, sometimes somewhat irregularly, over the head, up the limbs and along the flanks, creeping gradually up the sides toward the median line of the back, and from the rump anteriorly, leaving the crown, the sides of the head (malar regions), and the anterior and median portions of the back as the parts last to undergo the change of coat. Indeed, so simple and so matter of course is the whole process, that the only excuse for giving so detailed an account of the change is the fact that exceedingly erroneous statements of the process have not only found their way into print, but have also been made the basis of other generalizations.

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[1] In addition to the evidence of a molt afforded by skins, as already given, I am assured by Mr. Rowley and Mr. Granger, independently of each other, that they noticed in preparing the skins of the fall specimens in change that the long brown hairs came out very freely, while there was no noticeable shedding of the white hairs.

VERNAL CHANGE.

My studies of the vernal change are based primarily on specimens taken in the vicinity of Hartland, Vermont, during the present spring (1894)—a season remarkable for the great and almost unprecedented warmth of the first three weeks of the month of March. Hence the molt may have begun this year somewhat earlier than usual for this locality. This series is admirably supplemented by a series from Elk River, Minn., taken March 24 to May 11, 1886, kindly loaned me by Dr. C. Hart Merriam from his private collection for use in the present connection.

Three specimens, taken March 25, present the following conditions: No. 7289, ♂, differs little in superficial appearance from midwinter specimens. A close examination, however, shows that it has already lost the long soft white overhair from the ears—so conspicuous a feature of the basal portion in winter examples—and that a portion of the long white overhair of the body has been lost. On separating the pelage a few small patches of the summer pelage can be found here and there, where by accident, or in fighting, the old hair has been torn out, and the new coat has come in, as on the shoulders and hips. Here the summer coat, only a few millimeters in length, is coming in in a uniform, compact mass. It presents all the characteristics of the summer coat, as far as it has advanced, generally showing only the black tips and a portion of the broad subapical zone of fulvous.

A second specimen (No. 7290, ♂) is almost precisely similar, except that the hairs of one of the small patches of new fur on the middle of the back are more than half grown, thus showing a part of the black basal portion below the fulvous zone. A third specimen (No. 7288, ♀) is quite different, having shed *nearly all of the long overhair*, only a few scattered white bristly hairs remaining, so few that they might be easily counted. The heavy coat of long thick underfur, however, remains apparently intact, and, strange to say, the animal looks *nearly as white as before it lost its overhair*. It serves to show in a striking manner that the surface of the underfur is also white, as well as the overhair; and having seen it thus demonstrated, it is easy now to discover on careful examination, that the surface of the underfur is generally white in winter specimens. This specimen also shows numerous patches of new hair on the back where the old coat has been violently removed.

Two specimens, taken April 1 and 2, exhibit the progress of ten days. In both of these (No. 7285, ♂, and No. 7286, ♀) the greater part of the overhair has been shed, and there has evidently been a great reduction in the amount of underfur. In addition to this the new summer fur can be seen coming in somewhat uniformly over most parts of the body; though somewhat thinly dispersed it can be easily seen on parting the underfur.

Two specimens killed April 9 (Nos. 7291 and 7292) carry the change much further. No. 7291, ♀, has lost all of the winter coat of overhair, except here and there a few remotely isolated hairs. The patches of new hair, replacing bunches lost by accident, have now reached the level of the still heavy coat of underfur. There is less short new hair generally dispersed over the body than was found in the two specimens of a week earlier date, above described; but very interesting changes have taken place on the head, and on the summit of the shoulders, where a large increment of the summer fur has risen to the surface of the underfur. A large part of the white hairs of the winter coat still cover the sides and top of the nose and extend back in a triangular patch to a point between the orbits; but on either side of this median line, from a point considerably in advance of the eyes back nearly to the crown, the summer pelage is quite fully developed, and the winter hair has disappeared. A similar patch occupies the upper part of the cheeks, just below the eyes, and new summer hair is abundantly dispersed throughout the crown.

No. 7292, ♂, is much more advanced. There are scattered new hairs over much of the body, as yet concealed by the overtopping underfur; the feet, particularly the hind feet, are more advanced in change, and the whole head, including the cheeks, has become invested with the summer coat. The pelage is still short, and in places presents a patchy appearance, as over the nose and on the posterior part of the cheeks, where irregular tufts of the winter coat remain, conspicuous by its greater length and white color. The ears appear practically unchanged, retaining an unusual amount, compared with the other April specimens, of the long, white winter hair. Over the shoulders and on the hinder part of the back are numerous patches of the nearly full-grown summer pelage, with its characteristic mixture of fulvous-barred and black-tipped hairs.

Of two specimens taken April 15 one (No. 7295, ♂) is less advanced than No. 7292 (described above), taken a week earlier, it still retaining much of the long white overhair over the posterior third of the back, and the ears are nearly as white and as well clothed as in winter; and generally the specimen is in a very backward condition of change. The other (No. 7294, ♀) is in a very advanced stage of change, excepting the ears and feet, which still remain nearly as in midwinter. The entire head, the pectoral ruff, and the whole central part of the dorsal region nearly back to the hips, have taken on the characteristic dress of summer, the summer pelage protruding above the underfur, though not yet of mature length. There still remain, however, many long white hairs over the middle of the back, especially posteriorly, and there are small tufts of white hair on the sides of the head. On the sides of the body and over the posterior part of the back the summer coat is largely concealed beneath the still persistent winter underfur.

These are the last of the Vermont series received up to the date of this writing, but fortunately the specimens from Elk River, Minn., already mentioned as received from Dr. Merriam, carry the change forward to almost full summer pelage. These will be described somewhat in detail, although covering in part the ground already traversed, the locality rendering them of especial interest in this connection. The seven specimens were taken at such well chosen intervals (March 24 to May 11) that they show the leading stages of change throughout the whole period of molt.

No. 2545 (Coll. Dr. C. Hart Merriam), ♂ ad., March 24, has begun to lose the long white overhair, particularly on the ears, sides of the shoulders and middle of the back, and patches of the new summer coat have appeared on the front of the head near the eyes, that on the left side being about twice as large as the one on the right side. Another specimen (♀), taken March 27, is slightly more advanced, having lost most of the long white overhair from the back, and over which area considerable new hair has just appeared above the skin, as can be seen by carefully parting the underfur.

No. 2546, ♀, April 1, has lost nearly all of the long white overhair, except from the ears and feet, and the new summer pelage is coming in abundantly and quite evenly over nearly the whole dorsal surface, including the sides of the body as well as the back, much of it being already 5 or 6 millimetres in length; while little patches here and there have reached the surface of the underfur, and over a large part of the head it has quite replaced the winter coat. No. 2551, ♀, April 7, is a little more advanced, the summer pelage being well developed over the whole head, except a small central area in front, over the nasal bones, and has attained considerable length over the whole dorsal surface, though still buried in the winter underfur. A few long white hairs are scattered over the dorsum—remnants of the winter coat of long white overhair.

In No. 2549, ♀, April 8, the summer pelage thickly clothes the head, sides of the shoulders and a very broad area on the back, extending as far back as the hips. Over all these parts it overtops the underfur, and gives to the surface of the pelage the characteristic color and texture of the summer dress. From the hips, posteriorly, and along the sides of the body, it is much less abundant and still concealed beneath the underfur.

The next specimen in the series (No. 2555, ♂) was taken April 23, and is nearly in full summer dress, except on the feet and ears, although the pelage is still short. There are little tufts of white hairs—remnants of the winter coat—still remaining here and there on the back and sides. This is the first specimen of the Elk River series that shows much change in the pectoral ruff or on the feet, the ruff in this example having taken on the character of the summer dress.. On the forearm the summer pelage has advanced on the outer side to a point about half way between the elbow and wrist, superseding the winter coat, and below this point much of the winter coat has either fallen out or worn off. On the hind feet a nearly complete change has advanced as far as the ankle joint, and the feet are ragged and worn, having lost much of the winter coat.

The last specimen of the Elk River series (No. 2553, ♀, May 11) has practically attained, so far as the head and body are concerned, the summer dress, except that the pelage appears not to have attained its mature length. The ears and tail still show traces of the winter pelage, and the feet are but little more advanced in change than in the specimen last described.

From the foregoing it is obvious that the spring molt, like the autumnal, occupies a period of from fully four to six weeks, the latter probably being about the average length of time required for the complete change of dress.

In tracing the change from the winter to the summer coat we have spoken only of the change of the overhair. A comparison, however, of the specimens last mentioned with those first described in the Elk River series, or of summer with winter specimens, renders it evident that the underfur is changed as well as the overhair. The summer underfur is at least three-fourths less in amount, is shorter, and apically quite different in color. It appears to grow simultaneously with the overhair, the old coat of underfur being retained as a protection from cold for some time after the winter overhair has fallen out, and much later giving place gradually to the new coat, as the latter becomes sufficiently developed to afford the necessary amount of warmth. Whether or not the summer underfur is molted in autumn it seems almost impossible to determine, but that there is at this season a heavy growth of new underfur is plainly obvious.

IRREGULARITIES IN CHANGE OF COLOR, ETC.

An examination of the present series discloses various irregularities in the development of the white winter dress, in respect especially to the color of the feet, ears and head. In most specimens that have completed the winter dress the feet, except the soles, are superficially white, the whiteness varying greatly in purity in different specimens, while others, particularly on the fore feet, present large areas of fulvous. In those with the whitest feet, the hairs are wholly white to the base, and the underfur is pale plumbeous, with no tinge of fulvous. In other specimens the underfur varies from pale fulvous to deep rich fulvous, and in these latter the hair basally, in part or wholly, has the same tint, the hairs varying, in different specimens and also over different parts of the same foot, from pure white nearly or quite to the base to wholly fulvous, or fulvous with a white tip of variable extent in different hairs situated in close proximity. In this way the dorsal aspect of the foot varies from uniform clear white to white mixed more or less irregularly with fulvous, or to nearly deep pure fulvous, shading off laterally or at the edges into white.

The ears vary similarly except that the underfur is more commonly dusky, and the white surface is varied with dark chestnut or rusty brown rather than fulvous.

Usually in the specimens with brownish ears and fulvous feet the whole head shows a tinge of fulvous, which proves to be due in part to the shortness of the white tips to the hairs, as well as to the fulvous underfur. In specimens with a yellowish cast to the nose it is found that only the extreme tips of the hairs are white, all of the subapical portions being fulvous, passing at the extreme base into dusky. Often in specimens with very white heads the underfur is mostly dusky. In spring the ears lose their winter covering very irregularly, it being sometimes shed very early in the molt, and sometimes remaining till the summer pelage is well developed over the whole body.

Unfortunately there are no specimens at hand representing the partial change to white supposed to frequently occur at southern points in the habitat of this species, and is known to be the case in *Lepus campestris.* Reasoning, however, from analogy, and from the condition of the specimens just described, there is no ground for supposing the lack of complete change in color to be due to an imperfect autumnal molt, but rather to the fact that the new hair comes out largely of some other color than white.

Whether or not the soft underfur is also shed in autumn cannot readily be determined, but from its increased length and abundance in winter, as compared with summer and early autumn, it is evident that if not wholly renewed it at least is very greatly augmented.

In the case of the spring molt, there is little doubt that the whole pelage is renewed, the underfur quite as completely as the overhair.

In the case of wounds from fighting or other cause, resulting in the violent removal of large bunches of fur, it is interesting to note that in the autumn the new hair comes out white, often weeks in advance of the general change, and that in spring, under similar circumstances, the hair comes out brown, like the summer coat, much in advance of the general change from winter to summer pelage.

CONCLUSIONS.

From the foregoing it is evident (1) that the change of color, both in autumn and in the spring, is due to a change of pelage, and not, even in the fall, to a change of color in the hair itself. (2) Further, that this change is gradual, occupying many weeks, both in fall and spring; and that while it may be doubtless more or less accelerated or retarded by temporary climatic conditions, it is not intimately connected with phases of weather, but is as regularly periodic as the seasons themselves.

(3) That the method of change, as regards the parts first affected, is the reverse in spring of the order characterizing the autumnal change: in the fall the change beginning with the feet and ears, the sides of the nose and front of the head, which often become radically changed before the body is much affected; while as regards the body, the change begins first at the base of the tail and extreme posterior part of the back, and at the ventral border of the sides of the body, working thence upward toward the median line of the back and from behind anteriorly, the crown of the head and a narrow median line over the shoulders and front part of the back being the parts last changed. In the spring the order of change *is exactly the reverse*, the molt beginning on the head and along the median line of the anterior half of the dorsal region, extending laterally and gradually to the ventral border of the sides of the body and posteriorly to the rump, and then later to the ears and down the limbs to the feet, which are the parts last affected, and which often remain but little changed till the head and body have pretty completely assumed the summer dress.

(4) That for some time during the early part of the spring molt, after the white overhair has been shed (except for a few

scattered hairs), the pelage consists chiefly of the heavy coat of soft winter underfur; later this gradually disappears, probably partly by wearing off and partly by falling out, as the summer coat thickens and matures.

(5) That in spring the molt occurs quite as early and proceeds just as rapidly (if not a little more so) in the females as in the males, and that the molt is practically completed before the young are born.[1] This is noteworthy as being just the reverse of what occurs in many of the Sciuridæ, especially in the genera *Sciurus* and *Tamias*,[2] in which the males molt much earlier than the females, the molt in the latter being delayed not only till after the young are born but till near the close of the nursing period.

HISTORY OF THE SUBJECT.

More than a century ago, Thomas Pennant, a most astute naturalist for his time, gave the gist of the whole subject in a short paragraph of five lines, as follows: "From *Hudson's Bay*, as low as *New England*, these animals, at approach of winter, receive a new coat, which consists of a multitude of long white hairs, twice as long as the summer fur, which still remains. About the middle of *April* they begin to shed their winter covering."[3] Omitting the last clause of the first sentence, we have the whole case well stated. Later writers, however, conjectured another cause for the autumnal change. Thus, Dr. Richardson (afterwards Sir John Richardson) believed "that the change to the winter dress takes place by a lengthening and blanching of the summer fur."[4] This view appears to have been widely entertained by both scientific and non-scientific writers. But no one appears to have made any attempt at a thoroughly scientific investigation of the matter prior to 1869, when Assistant Surgeon Francis H. Welch published an elaborate paper on the subject.[5]

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[1] Judging by the condition of the embryos in females taken late in April, when the change to summer pelage is well advanced.

[2] See this Bulletin, Vol. III, pp. 42, 44 and 49, 50.

[3] Arctic Zoölogy, Vol. I, 1784, p. 96.

[4] Fauna Boreali-Americana, Vol. I, 1829, p. 218.

[5] 'Observations on *Lepus americanus*, especially with reference to the Modifications in the Fur consequent on the rotation of the Seasons, and the Change of Colour on the advent of Winter; based on Specimens obtained in the province of New Brunswick, North America.' By Francis H. Welch, Assistant Surgeon, 1st Battalion, 22d Regiment. <Proc. Zoöl. Soc. London, 1869, pp. 228-236.

Unfortunately it consists of a singular mixture of truth and error, although looked upon as authoritative by subsequent writers. In fact, it is difficult to understand how the author could have been so misled, or could have been so unfortunate in his observations. His detailed statements as to the change in color, so far as its gradual progress is concerned, leave little to be desired, but in accounting for the change, or in attempting to explain the cause and manner of the change, it is evident at once that his observations were faulty and superficial, notwithstanding his apparently extensive use of the microscope in his investigations.

He says: "About the commencement of October the first indications of the hybernal change are to be detected: the nose and lips assume an iron-grey hue, from the presence of white hairs; many of the whiskers are white at the tip or some portion of the shaft; a patch of white hairs, twenty to thirty in number, of the size of a split-pea, forms on the centre of the forehead; white hairs become apparent on the edges of the ears outside and at their junction with the neck, while on the inside a crop of downy white fluff springs up; a few of the longer hairs of the pile of the back, especially towards the tail, are observed to be blanched wholly, or only at the tips, while the greater part of the smaller kind are brown at the tip, with the tawny band of the shaft much lighter in color or even white; the anterior surface of the feet, especially of the hind ones, is mottled with white. Thus far," he continues, "the most careful examination fails to elicit any addition to the autumnal coat, the change being superficial and entirely dependent on an alteration of colour in existent hairs."

With the material at present before me it is hard to understand how such a conclusion could have been reached. The only explanation that suggests itself is that specimens were casually examined from time to time in the flesh and not preserved for detailed study and comparison in series. For later on he appears to have discovered the new growth of hair, for he says: "During November this surface-change gradually deepens in intensity, ...and is accompanied by a deeper one of a much more potent character; for on separating the fur a thick crop of white stiff hairs (first apparent at the root of the tail) is to be detected springing up over the back and sides. These hairs, at first extremely minute and entirely of a new growth, rapidly increase in length, accompanied by an advance in the superficial changes above mentioned; soon they are on an equality with the pile of the autumnal coat on the sides, forming a mottled whity-brown band from ears to tail, contrasting strongly with the centre of the back, at present comparatively unchanged; anon they outstrip this, reducing the mottling on the sides to a pure white, and, gradually implicating the centre of the back in the same process ....they clothe the animal in a thick white outer garment, generally assumed about the first week of December. As soon as the new growth renders itself superficially evident, the change of colour in the old hair, which on the back up to this time has been slow in progress, advances with great rapidity, so that in a few days only a few coloured hairs, generally remaining unchanged throughout the whole winter, can be detected" (l. c., pp. 230, 231).

Later on he says: "Thus the winter hue would appear to be brought about by a change of colour in the pile of the autumnal coat combined with a new hybernal white crop, the latter undoubtedly playing no small part in the colouring process and in the thickening of the fur. *There is no indication of shedding.*[1] An increase in length ensues over the whole body....The process may be summed up as a combination of colour-change (except in the underparts) of the lengthened outer hairs of the autumnal [=summer] coat, with an additional hybernal growth; the former universal over the body, *the latter limited to certain portions*"[1] (l. c., p. 232).

There is so much to be corrected in the foregoing quotations that the points may best be taken *seriatim*.

(1.) First, as to the whiskers, which elsewhere, it is said, "will demonstrate each variety" of the "blanching process" of the hairs. My series of over seventy specimens shows that the color of the whiskers is entirely independent of any seasonal color-change of the general pelage. They may be either all black, as in many of the midwinter specimens, as well as in some

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[1] Not italicized in the original.

October and November specimens ; or part white and part black, or even the same hair particolored, as happens about equally in early fall specimens and in December, January and March specimens. This feature appears to be a matter of purely individual variation, having no relation to season.

(2.) Secondly, the small white spot in the forehead. This is a mark more or less common to all species of Leporidæ, including those that do not change to a white winter dress. It varies in extent from three or four white hairs to much more than "twenty to thirty." It is especially frequent in *Lepus americanus* while in the *summer coat*. It is present in 10 out of 18 fall specimens now before me, in which the crown is unchanged by molt, and also in a large proportion of the April and May specimens in which the head has acquired the full summer dress. Being found all summer, and more or less commonly in all Hares, it evidently is not one of the early stages of change to the winter coat, either by a "blanching process," or any other.

(3.) As already said, the failure to discover a new growth of white hair about the nose, sides of the head, and on the ears and feet, must have been due to faulty observation, since my specimens demonstrate its presence beyond question. Some show it so plainly that it is impossible not to recognize it on the most hasty inspection ; in others the fact that the short white hair is a new growth is not so obvious, so that a mistaken interpretation of the facts might easily be made by one unaware that the absence of a new growth would be an anomaly, and in opposition to what occurs as a rule in mammals. Besides, as already shown, the pelage of the sides of the nose, the feet, and sometimes of the greater part of the head, is often, even in midwinter, only superficially white, even the coarser hairs being only tipped with white, easily leading to the inference that they were undergoing a "blanching process." This erroneous departure has obviously influenced the author's whole subsequent work, which his discovery later on of the new growth, when more advanced, failed to correct, and led to the false assumption that the change of color over the whole body was due largely to the blanching of the old hair.

(4.) It is assumed that the old hair is *not shed*, but suddenly assumes new vitality and proceeds to "increase in length," and to take on an entirely changed molecular structure, for he says elsewhere (l. c., p. 233) that "to this [increase in the length of the autumnal hairs] must be added that the blanching shaft, in the majority of cases, has also augmented in thickness....the increase being consequent upon a more than usual number of series of cells entering into its composition." And again (l. c., p. 234): "It would seem that the rapid development of new hairs .... involves the autumnal outer fur in the same process, leading to an increased length and thickness in the shaft of the hair by the superposition of layers of the same colourless cells entering into the structure of the new growth—perhaps combined also with an arrested production of pigmentary matter." This is further elaborated in such detail of explanation, based on microscopical examinations, that it would seem to rest on a solid basis, but I must confess that to me the case is simply incomprehensible. My material certainly demonstrates that the summer coat is shed, and not transformed, either in structure or color. On the other hand, it does not need even the aid of a magnifying glass to show that the winter coat of long white overhair is of a finer and softer texture, with a much smaller (instead of larger) diameter of shaft than the summer coat, which is coarser, harsher to the touch, and of a different structure, the particolored (not the wholly black to the same degree) hairs of the summer coat being subapically thickened, the thickened portion including the fawn-colored band, and extending slightly above and below it. Hence, the only explanation that occurs to me is that the thickened hairs were a part of the old summer coat, which it was assumed were in process of change, or about to change to white, simply from the fact that the brown hairs were disappearing, and that he compared these old hairs with the new hairs of the winter coat. Again, in specimens well advanced in change, on casually parting the pelage of the back, the new white hairs are so abundant and conspicuous that all of the hairs seem white below the surface, but on removing some of the hairs still remaining of the summer coat they are found to be colored to the base and still unchanged.

In a January specimen (No. 3277, Rutland, Vt., Jan. 8) a small proportion of the hairs over the dorsal region are pure white for rather more than their apical half, and then pass into a broad band of very pale horn-color, which usually fades out basally, or may persist faintly to the base of the hairs. In texture and size they do not differ from the pure white hairs with which they are intermixed. A very few of these basally faintly horn-tinted hairs can be found in another specimen taken at the same time and place, and in one out of three early March (March 2) specimens from the same locality. Also a specimen from Locust Grove, Lewis Co., N. Y., taken March 21, 1884, and kindly loaned me by Dr. Merriam, is a fine example of this phase of coloration. In this specimen many hairs still remain wholly black, others are only black, or more or less blackish, basally. These hairs are evidently, however, in each case, a part of the true winter coat, and not a remnant of the summer coat, any more than are the fulvous hairs on the fore legs and hind feet of certain midwinter specimens, or the basally fulvous hairs on the nose, or the fulvous hairs on the ears, of these same specimens. They simply grew particolored instead of white, and have not either the texture or the form of the particolored hairs of the summer coat. Yet, although so exceptional, they might, considered alone, seem to give some support to the 'blanching' theory of the autumnal change of color.

So much attention would not be given, in this connection, to Mr. Welch's paper, in view of the overwhelming evidence of its erroneous character, were it not that it has recently been made prominent by Mr. E. B. Poulton as the chief basis for his theory respecting 'Variable Protective Resemblance in Vertetrates,'[1] in which he either quotes at length or summarizes from Mr. Welch most of the passages above quoted, and proceeds to theorize from this insecure basis.

In conclusion it may be well to correct a time-honored error respecting the geographical distribution of *Lepus americanus*, since it figures prominently in the matter of seasonal change of color. Thus Mr. Poulton (l. c., p. 97), in speaking of this species, says: "In Hudson's Bay Territory it changes early and carries the winter coat till June, while no change of colour takes place in the winter in the *southern parts of the United States*,"[1] basing the statement probably on Welch (l. c., p. 235), who in turn quotes it directly from Sir John Richardson. Richardson seems to have derived the statement from Pennant, as he says (Faun. Bor.-Am., I, p. 218): "The white color is less perfect in more southern districts, and to the southward of New England, according to Pennant, the brown dress endures all the year." Pennant, in his 'Arctic Zoölogy,' recognized only two species of North American Hares—the Varying Hare and the American Hare. The first is the Arctic Hare of the present day; the other was primarily the Varying Hare here under consideration, but included also all other species of North American Hares then known. Hence when he says, "From *New England* southward they retain their brown color the whole year," he is evidently speaking of the 'Cotton-tails' and Swamp Hares of the South, which, as every one knows, never turn white. It is needless to tell intelligent mammalogists that the southern limit of distribution of the Varying Hare is the southern half of the Alleghanian Fauna—in other words, it is not found at ordinary levels south of Massachusetts. Furthermore, there is little evidence to show that it does not practically become white in winter to the very southern limit of its range, although less perfectly so than further north, the change in color sometimes remaining more or less incomplete and superficial, so far as can be determined at this writing.

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[1] *Cf.* 'The Colours of Animals,' Chap. VII. Intern. Sci. Ser., Vol. LXVII. New York, Appleton & Co., 1890.

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[1] Not italicized in the original.

Article V.—OSTEOLOGY OF PATRIOFELIS, A MIDDLE EOCENE CREODONT.

By J. L. Wortman, M.D.

Plate I.

History and Synonomy.

The genus *Patriofelis* was originally established by Dr. Leidy, in the 'Proceedings' of the Philadelphia Academy, March, 1870, p. 10, upon the fragmentary portions of the rami of both lower jaws, which were obtained by Dr. Hayden in the Bridger Baisin, Wyoming, the year previous. In August, 1872, Prof. Marsh described (Amer. Jour. Science, Vol. IV, p. 10.) from the same locality, some remains of a "gigantic Carnivore" which he referred to a new genus and species under the name of *Limnofelis ferox*. According to Prof. Marsh's statement, his specimen consists of portions of the skull, fragments of the lower jaw, some vertebræ, and other less important parts of the skeleton. In the same paper he describes a second species under the name of *Limnofelis latidens*, from a last upper premolar, which was obtained in the same horizon. Prof. Cope, in the 'American Naturalist' of 1880 (Vol. XIV, p. 745), proposed a third genus from teeth and limb bones, which were collected by the writer in the Wind River Baisin in the summer of 1879. To these remains Prof. Cope gave the name *Protopsalis tigrinus*. Prof. Scott has described in the 'Journal of the Philadelphia Academy,' 1886 (Vol. IX, p. 174), some remains of a large Creodont from the Bridger formation, which he referred to Prof. Cope's genus *Protopsalis*. A new species of this genus was proposed by the writer (Bull. Amer. Mus. Nat. Hist., Vol. IV, p. 98, 1892), under the name of *P. leidyanus*, from a specimen in the Princeton Collection.

The material collected by the American Museum Expedition into the Bridger Baisin now enables me not only to give an unusually full description of the osteology of the species of

Patriofelis, but to establish the synonomy of the three generic names that have been proposed.

A careful comparison of Marsh's description of *Limnofelis ferox* with Prof. Cope's figures and description of *Protopsalis tigrinus* leaves little doubt of the generic identity of the two specimens. Both of them, moreover, agree so perfectly with our specimens, that I do not hesitate to refer them to the same genus. Marsh's description is characteristically brief and imperfect, but enough is stated to indicate that the last lower molar of *Limnofelis* is the same as that of *Protopsalis*, which is in turn like that of *Patriofelis*. Marsh's specific name *ferox* is therefore adopted, since it has priority. A comparison of our specimens with Leidy's type of *Patriofelis ulta* reveals a difference only in size, our largest specimen being at least one-third larger in every way. I am therefore convinced that *Limnofelis* and *Protopsalis* do not present any characters, so far as known, which will enable one to separate them generically from the genus originally proposed by Leidy, namely, *Patriofelis*.

The specimens upon which this paper is based were found in the Bridger Baisin at widely separated localities. The most complete is from the Henry's Fork region ; several other specimens of both the species were found at Twin Buttes, and their remains are likely to occur wherever the exposures contain fossils. The larger species, *P. ferox*, is one of the largest Creodonts known, and equaled in size a full-grown black bear. The head was disproportionately large and massive, almost equaling in this respect an adult lion. The smaller species, *P. ulta*, was about one-third smaller. In both, there was a long and powerful tail, broad plantigrade feet, which, together with other characters presently to be considered, lead to the conclusion that they were aquatic in habit.

The subject is considered under the following heads : *History and Synonomy ; Osteology ; Comparison with other Creodonts ; Comparison with the Seals ; Probable Habits ; Classification and Species.*

I.—OSTEOLOGY.

MATERIALS FOR DESCRIPTION.—The most important specimen in our collection, pertaining to the larger species, consists of an almost complete skeleton remarkably well preserved. The skull and lower jaws are present, but unfortunately somewhat damaged. The teeth are mostly wanting, but in the lower jaw the fangs of the entire series are preserved, so that their number can be determined. The facial part of the cranium is, moreover, considerably damaged, but at least two of the upper molars are sufficiently preserved to admit of a determination of their structure. With the exception of some of the cervicals and the first two or three dorsals, the vertebral column is complete and well preserved. Nearly all the ribs of one side are present, as are also a number of the sternebræ. The fore limb is represented by a scapula, part of a humerus, ulna, and radius, and nearly all the manus. The pelvis is wanting, but both hind limbs are well nigh complete. In a second specimen, somewhat smaller, one ramus of the lower jaw, bearing the premolars and a damaged first molar, is present, together with many important parts of the limbs. A third specimen includes a part of the hind foot with the greater part of the pelvis. A fourth specimen contains the pelvis, hind feet, vertebræ, humerus, scapula, ulna, radius, and part of the fore foot.

SKULL.—The single skull of *Patriofelis* contained in the collection is considerably damaged. When found it had already been weathered out of its matrix, and consisted of a heap of fragments. These, after much labor, have been put together and the result is a fairly satisfactory skull. Of this the posterior part, including the condyles, occiput, mastoid processes, brain-case, glenoid cavities and the zygomatic arches, is tolerably perfect. The greater portion of the top of the skull is also preserved, including both postorbital processes with the divergent roots of the sagittal crest posteriorly almost to the point of their junction, together with the greater part of the right nasal bone to its anterior free extremity. There is also a part of the left maxillary, reaching from its point of junction with the frontal forwards and downwards in front of the infraorbital foramen, so as to include the roots of the first two premolars and the posterior wall of the left canine alveolus. The anterior portions of the zygomatic arches, moreover, have attached to them the posterior parts of the maxillaries, which, upon the left side, contain the last molar in position with the roots of the one immediately in advance of it. The posterior termination of the infraorbital is also indicated. There is in addition to the parts already mentioned the right anterior wall of the anterior nares, showing the alveoli of the canine, together with the lateral incisor, that is not connected by actual contact with the rest of the facial bones.

I have thus described at length the pieces as they actually exist for the reason that there is a possible source of error in the construction of the face. The top of the skull is not connected by contact with the rest of the bones, and it may be placed too far forwards; but taking into consideration the sweep of the divergent branches of the sagittal crest, the position of the post-orbital processes, as well as other points, I am led to believe that it is approximately correct. The whole skull as thus restored is remarkable for its large size and general robustness as compared with the rest of the skeleton. Its size is quite equal to that of a lion, while the size of the body is but little if any larger than that of a black bear. The face is extremely short and broad, with high, wide anterior nares. Behind the postorbital processes the

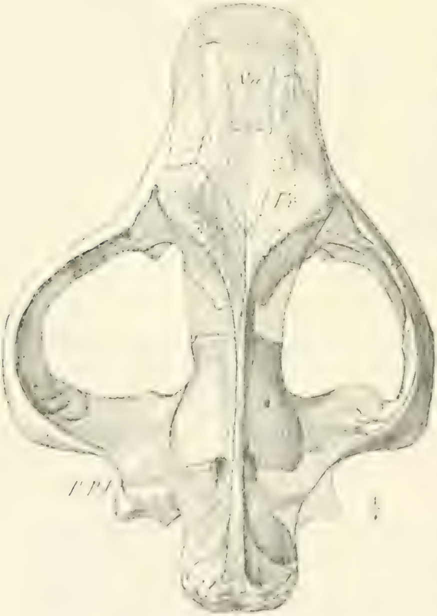

Fig. 1. *Patriofelis ferox.* Skull from above, ¼ natural size.

skull is much constricted, as in the seals, and there is a correspondingly long interval between the postorbitals and the anterior termination of the brain cavity. The sagittal crest is unusually high and prominent, and is continued far in advance of the brain cavity, as in the sea-lion ; it terminates posteriorly in a comparatively narrow, massive, overhanging occiput. Just above the posterior roots of the zygomatic arches at the base of the sagittal crest are seen two large postparietal foramina, which lead downwards into the lateral sinuses.

The zygomatic arches are remarkably heavy and widely expanded. The glenoid cavities have great lateral extent, and are provided with anterior and posterior glenoid processes, as in many of the fissiped Carnivora and the sea-lion. The mastoids are large and prominent ; the paroccipitals are conspicuous and closely applied to them. The tympanic bullæ are not preserved. The basioccipital is relatively broad and deeply marked for muscular insertion. The condyles are small in proportion to the size of the skull, and the foramen magnum is higher than it is wide, as in the seals. The occiput is relatively narrow, of great vertical extent and overhangs the condyles, as in the feline skull.

The *foramina* cannot be determined with a great deal of satisfaction, but some of them are sufficiently preserved to admit of description. The optic foramina cannot be made out, but there is a distinct sphenoidal fissure, which is apparently not confluent with the foramen rotundum, as it is in the sea-lion. A very distinct and well-marked groove extends from the opening of the

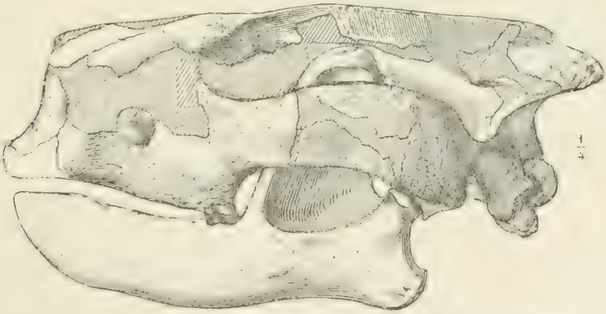

Fig. 2. *Patriofelis ferox.* Skull from side, ¼ natural size.

foramen ovale, forwards to the opening of the foramen rotundum, and undoubtedly indicates the presence of an alisphenoid canal. The presence of a foramen lacerum medium cannot be determined, but a deep groove in the side of the basioccipital represents a large carotid canal, which would be completed were the tympanic bullæ in position. The region of the posterior lacerated and condyloid foramina is too much broken to show them distinctly. There are no post glenoid foramina. The stylomastoid has its usual position, and forms a deep groove between the mastoid and paroccipital process. There is another foramen of considerable size which opens backwards and downwards upon the posterior wall of this process. This foramen appears to be peculiar, and is not represented in any of the modern Carnivores.

The *brain-case* is very small in proportion to the size of the skull. While the skull is considerably larger than that of the sea-lion, the actual capacity of the cranial cavity is less than one-third as great. Its walls are remarkably thick. The cerebellum was entirely uncovered by the cerebral lobes, and the tentorium was very little, if any, ossified. The cerebral cavity shows that there were at least two longitudinal or suprasylvian convolutions, much as in the more primitive carnivorous brain. There is no satisfactory evidence of a crucial sulcus. The cerebellum was relatively large, and the walls of its cavity are unusally thick. The roof is marked by a deep longitudinal furrow for the lodgment of the vermis of the cerebellum.

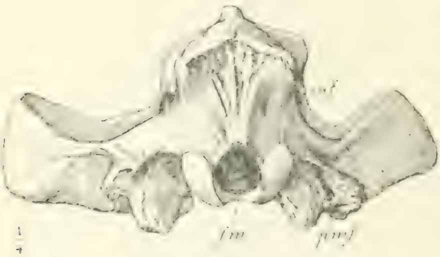

Fig. 3. *Patriofelis ferox.* Skull. occipital view, ¼ natural size.

The *lower jaw* partakes of the nature of the skull, and is remarkably heavy and robust. The horizontal rami are short and deep. The symphysis is rather short, and the chin abruptly rounded. The last molar is placed close against the base of the coronoid process, which rises rapidly and does not overhang the condyle. The masseteric fossa is wide and deep; the condyles, which are placed low, have great transverse extent and a scroll-like pattern, as in the cats. The angle is well rounded and little produced, as in *Oxyæna.* The inferior dental canal is large and situated below the level of the tooth line. The inferior border of the jaw is nearly straight.

The *dentition* is but very little known, and our material does not, unfortunately, throw very much light on the subject. From Leidy's type specimen of *P. ulta* the number of molars and premolars in the lower jaw was determined to be five, of which three have been considered Pms. and two Ms. There were either four or five teeth in the upper jaw belonging to this series. I am inclined to the opinion that there were only four, of which three were Pms. and one M. Although the roots of the first two premolars above are preserved in the fragment of maxillary attached to the skull, it is difficult to determine whether the first one was single or double rooted. Now in *Oxyæna* there are four Pms. and two Ms. in the upper jaw, of which the first Pm. is single rooted and the last M. is transverse to the long axis of the jaw. In *Patriofelis* the last tooth is not transverse, and if *Patriofelis* is descended from *Oxyæna* directly, which I think the evidence demonstrates beyond question, the last upper tooth of *Patriofelis* must represent a single molar, since it would have been manifestly impossible for the transverse tooth to become again longitudinal. The transverse position is the first step in its disappearance. In the same way it may be determined that if the first Pm. is single rooted it represents the first Pm. of *Oxyæna*, and if two rooted it represents the second Pm., in which case there would therefore be only four teeth behind the canine. In our specimen it has the appearance of being two rooted, and I therefore consider the formula to be I. $\frac{3}{2},^{(?)}$ C. $\frac{1}{1}$, Pm. $\frac{3}{3}$, M. $\frac{1}{2}$.

The structure of the last upper tooth of *Patriofelis* is not distinctly shown in our specimen on account of the extreme wear of the crown ; enough is preserved, however, to show that it had a well-developed sectorial structure. The para- and metacones are apparently completely fused so as to form an anterior blade, the posterior blade being furnished by the prolongation of the heel, as in *Oxyæna* and *Hyænodon.* If there were an internal cusp in the unworn tooth it must have been small. There is another upper tooth in the collection from another individual, which I take to be either a first molar or the last premolar. It repeats the structure of the tooth just described, with the exception that the anterior blade is relatively larger. It has three roots, of which two are anterior and one posterior, and the internal cusp was rudimentary or wanting. The structure of the anterior teeth is entirely unknown. The canines were large and powerful, and there were probably three incisors above. The outer one, judging from its alveolus, was considerably enlarged.

A fragmentary specimen of a lower jaw in our collection shows that there were but two pairs of incisors below. These are crowded in such a way that the median one has a position almost immediately in advance of the outer one ; the canine was large and slightly compressed laterally. The anterior (second ?) premolar is placed very obliquely to the tooth line ; it has a simple crown and two roots. The third is likewise two rooted, but the crown is not preserved. The fourth premolar is the largest of the series ; its crown consists of a single principal cone, to which are added an anterior and posterior basal cusp. Of these the posterior or talon is the larger, and there is some indication of a second small internal cusp to this part of the tooth ; this is suggested by the breadth and thickness of the talon at its base ; it is shown in Leidy's type of *P. ulta.* The crown of the first lower molar is broken beyond recognition, but if we are to judge from Cope's specimen from the Wind River, as well as from Leidy's type, it has a structure very similar to the corresponding tooth of *Oxyæna*, with a more reduced talon. The last molar of the lower series is not preserved in any of our specimens. It has, however, been described by Marsh, and agrees so perfectly with the tooth figured by Cope, as well as that of Leidy's type, that its structure may be regarded as fully determined. The whole tooth bears a striking resemblance to the sectorial of the cat.

VERTEBRÆ, RIBS, AND STERNUM.—Almost the entire vertebral column is preserved in our best specimen of *Patriofelis.* Counting from the sacrum forwards there were sixteen vertebræ in position, so that there is no chance for error as regards this much of the dorso-lumbar series. Of this number six are lumbar and the remaining ten are dorsal. As there are thirteen ribs of one side present in this same specimen, it is evident that there are at least three dorsals missing. I have therefore added these three vertebræ from another individual. There may have been one or two more, but I am led to believe that the number thirteen is approximately correct. This is the number usually found in the cats, but in the seals there are fifteen, and in the sea-otter there are fourteen dorsals.

The Atlas.—The general form of the atlas more nearly resembles that of the felines than any other of the existing Carnivora. This is especially seen in its vertical flattening, in marked contrast with the high arch and great vertical diameter of the neural canal of the sea-lion and sea-otter. Although the transverse processes are somewhat damaged in the single specimen which we possess, yet it is evident that they had a considerable lateral expansion, and are placed relatively high up on the sides of the bone, as in the cat, and not at its base, as in the sea-lion and sea-otter. In many of the Carnivora the transverse processes have a very marked backward direction, but this does not seem to have been the case in *Patriofelis*. There is a strong ridge occupying the upper anterior surface of the transverse process, which, so far as I am at present aware, is peculiar to *Patriofelis*.

The way in which the vertebral artery pierces the transverse process of the atlas in the different groups of the Carnivora is subject to considerable variation, as well as the form and direction of the transverse processes themselves, and in some of them, at least, these features are highly characteristic. In all of the Felidæ which I have had the opportunity of studying, the canal pierces the transverse process at its extreme posterior edge, where it is thickened and joins the body of the bone. The superior edge of this posterior border slightly overhangs the inferior edge. The process itself, moreover, in its fore and aft extension, is more or less parallel with the long axis of the neural canal. This character appears to be very constant in the Felidæ, and so far as we know the structure of the atlas in the more generalized Nimravidæ, it is true of them also. In the Canidæ, upon the other hand, the foramen for the vertebral artery is situated well in advance of the posterior border of the process, and instead of having a fore and aft direction, as in the cat, pierces the process almost vertically from above. In the Viverridæ and Hyænidæ the position of the foramen is very much as in the cats. There is, however, an important difference between these two families and the felines in the character of the canal where the artery enters the suboccipital foramen in the anterior part of the atlas. The difference consists in the formation of a bony bridge in this situation which gives to the suboccipital foramen a double opening in the hyænas and civets, whereas it is single in the cats. It is interesting to note, however, that in *Haplophoneus* the suboccipital foramen has a double opening, as in the Viverridæ and Hyænidæ. Among the bears and mustelines, the lower edge of the posterior border of the process is extended backwards considerably, and the upper surface of the process is marked by a strong ridge. This ridge corresponds to the superior lip of the posterior border of the transverse process in the cat. In the more typical seals the vertebral foramen is greatly enlarged, while in the sea-lion it is of more normal proportions, and its arrangement, as well as that of the transverse process, is very much as in the bears.

The *axis* does not offer any characters of unusual importance. The neural spine is large and overhangs the posterior zygapophyses, very much as in the cats. The centrum is circular in section at its posterior extremity, and not depressed and oval as in the cat. Upon its inferior surface the centrum exhibits a strong keel, much more pronounced than in any of the modern Carnivores. The odontoid process is missing.

In the succeeding cervical vertebræ the centra are convex in front and concave behind. They present a circular section at their extremities, and are strongly keeled beneath. The neural spine of the sixth cervical is preserved, and indicates a proportionately greater height than is seen in any of the cats. The transverse processes are not sufficiently preserved to admit of description.

The *dorsals*, as already stated, are very probably thirteen in number, and in the anterior part of the region have relatively small bodies, with well-marked convex surfaces in front and concave faces behind. This convexity and concavity gradually decreases towards the posterior part of the region until in the lumbars the central faces are nearly plane. In a like manner the centra increase rapidly in size posteriorly. The neural spines are not preserved, and their relative lengths cannot be determined, but judging from their roots they are relatively high and strong, as in the cats. The anterior and posterior zygapophyses are flattened oval facets which are directed upwards and downwards in the anterior ten of the series. The postzygapophyses of the tenth, however, become abruptly rounded or cylindrical, and are received into corresponding grooves in the succeeding vertebra. In the remaining dorsals, as well as the lumbar series, these articular processes become further complicated by the formation of a double tongue and groove, a character which, so far as I am now aware, is not found in any other carnivorous or creodont mammal. In the postzygapophyses the groove is superior and the cylindrical part inferior, while in the anterior zygapophyses this order is reversed. At the point where the zygapophyses change their character so abruptly, metapophyses and anapophyses appear and are well developed from this backwards. It is moreover at this point that the transverse process for the articulation of the tuberculum of the rib disappears, and the neural spine changes from a backward to a forward direction.

The *lumbars*, six in number, have large plane-faced centra, with a strongly developed inferior keel, which gives to them a somewhat trihedral form. The neural spines are strong and unusually broad, especially those of the last three vertebræ. The distal ends of the spines of the anterior three vertebræ are more or less thickened and tuberous. All the lumbars have well-developed transverse processes, as well as anapophyses and metapophyses.

The *sacrum* is made up of three vertebræ, of which two unite with the ilia at the sacro-iliac synchondrosis. The bone is relatively broad and heavy, in keeping with the large size of the lumbars in advance of it, and the powerful tail behind. The neural spines are present, although smaller in every way than those of the lumbar series.

The *tail* is well nigh complete, and consists of twenty-eight caudals. The proximal ones are large and strong, with well-developed transverse processes and complete articular processes. The neural canal and articular processes cease at the tenth from the sacrum, after which they present the pattern usually seen in the caudal region of the long-tailed Carnivora. There were numerous chevron bones, but none of them have been preserved.

The Ribs.—As already remarked there are thirteen ribs of one side preserved, together with numerous fragments of those of the other side. As this number agrees so well with the number of dorsals I am persuaded to believe that there cannot have been more than one or two pairs more than this number at the very utmost. The first rib is somewhat remarkable for its shortness and stoutness, together with the unusual size of its articular processes. It is considerably flattened, as are the succeeding three, after which they become more and more rounded. The last three have no tubercula, and articulate directly with the bodies of the dorsals.

The Sternebræ.—There are six sternal bones preserved in the more complete skeleton. These resemble the corresponding bones of the sea-lion more than those of the felines in their relative robustness and greater breadth. They are moreover much shorter than in any of the fissiped Carnivora.

Fore Limb.—The fore limb of *Patriofelis* differs materially from that of the fissiped Carnivora in the proportions of the various segments. The scapula, humerus, and ulna are of about equal length, while the radius and manus also compare very closely in this respect. In the fissiped Carnivora, on the other hand, the scapula is very generally shorter than either the humerus or ulna, the length of the ulna equals, or may exceed that of the humerus, and the length of the radius is always greater than that of the manus. In the Pinnipedia the proportionate lengths of the component segments are again different, The scapula is always longer than the humerus, the ulna is longer than the scapula, and the manus is again longer than the ulna. One of the chief peculiarities of the fore limb of the seal consists in the enlargement of the scapula and the elongation of the manus. In this respect, therefore, the fore limb of *Patriofelis* is more like that of the seals than the land Carnivores.

The *scapula* is relatively longer and broader than that of the cats, dogs, or bears. The prominent spine divides the external surface in such a manner that the greatest breadth of the two fossæ are about equal, whereas the greatest breadth of the infra-spinous fossa in the cat, dog and bear, always exceeds that of the supra-spinus fossa. In the Otariidæ, at least among the seals, it is the supra-spinous which is the larger.

The head of the scapula presents a rather shallow pyriform glenoid cavity, and is joined to the body of the bone by an exceedingly short neck. As a result of this arrangement the acromion, which is unusually large, overhangs the shoulder joint to a greater extent than is seen in any of the recent genera. The tubercle for the attachment of the long head of the biceps is well developed, and occupies its usual position on the dorsal or external portion of the neck on the coracoid side. The coracoid process is of moderate proportions, and is rather obtuse, as in the bears and dogs, differing in this respect from the cats, in which it is produced and pointed. On the axillary border, at the point of junction of the head with the body, is seen a well-marked roughened depression for the tendinous origin of a part of the *teres minor*. The spine is large and prominent, and is terminated proximally by a remarkably well-developed acromion. To this is added a large overhanging metacromion, whose dimensions greatly exceed that of the feline scapula, in which it is best developed of all the Carnivora. The glenoid or axillary border is thickened and raised above the general level of the infra-spinous fossa, and towards its posterior termination shows a relatively small though distinct area for the origin of the *teres major*. This area is unusually large in the bears and seals.

The *humerus* is remarkable for the enormous development of the deltoid crest, the great prominence of the supinator ridge, as well as the lateral flattening of the shaft. The bone is relatively short and robust, not exceeding the scapula or ulna in length, and the shaft is moderately bent. The head is small, laterally compressed, and its articular surface is prolonged backwards so as to overhang the posterior border of the shaft to an unusual degree.

The bicipital groove is single, deep and narrow, the tuberosities are quite prominent and robust, and are deeply marked for ligamentous attachment. The greater tuberosity rises above the level of the articular surface, and is somewhat compressed from side to side, having a very slightly oblique direction to the long axis of the head. This is more pronounced in the cat, and becomes almost transverse in the sea-lion. The deltoid crest is almost as prominent as it is in the sea-lion, and occupies at least five-eighths of the entire length of the bone. In this particular the humerus differs markedly from that of all the land Carnivora and approaches that of the seal. The distal portion of the bone shows a powerful supinator ridge, and deep and well-marked anticubital and anconeal fossæ. There is apparently no supertrochlear foramen, but a large entepicondylar foramen is present. The trochlea is relatively broad, and the outer margin is thin and produced downward almost as far as the inner border. The anterior face of the articular surface is convex on the outer side, and is received into the cup-shaped head of the radius. It is not so convex as in the cat but is more like that of the sea-lion. A large part of the trochlea is occupied by the head of the radius, so that pronation and supination must have been somewhat limited.

The *ulna* is a strong bone, and is remarkable chiefly for the length of its olecranon process. In this respect it exceeds any of the modern Carnivora. In the dog and black bear the olecranon is only about 10½ per cent. of the entire length of the ulna; in the puma it is about 12½ per cent.; in the sea-lion it is about 17½ per cent.; while in *Patriofelis* it is nearly 24½ per cent. The posterior wall of the sigmoid cavity is elevated more than is usual in the Carnivora, as is also the case with the coronoid process. The shaft is laterally flattened and deeply grooved upon the outside. There is also a shallower groove found upon the inside. The shaft is deepest at the coronoid process by reason of a considerable backward curve, which it makes in this situation. The distal end is fashioned into a short, though stout, styloid process which articulates with the cuneiforme.

The *radius* is short and robust. Its head is oval in section, and covers a large part of the humeral trochlea. It is probable that the movements of pronation and supination were more or less limited. The distal end of the bone is considerably expanded, but it does not exhibit the deep tendinal sulci which are seen in the modern Fissipedia. In this respect it is more like that of the sea-lion. It also shows a tendency towards the distal flattening of the shaft, a feature so conspicuous in the radius of the sea-lion. The distal articular surface is relatively small, and does not show separate facets for scaphoid or lunar, as one would be led to infer.

The Manus.—The carpus of *Patriofelis* is like that of the other Creodonta, in that the scaphoid, lunar and centrale are free. The *scaphoid* has about the same proportions and the general form of that of the cat, if the lunar and centrale were removed. Proximally it shows a single convex facet for articulation with the radius. Laterally it is applied very closely to the lunare by a nearly vertical facet, the proximal surface of the two bones forming a continuous convex surface. It is owing to this fact that the distal articular surface of the radius exhibits but a single facet. Distally but two facets can be distinguished, one for the trapezium, and another for the trapezoid and centrale. That for the trapezium is the larger of the two, in consequence of the abnormally large size of this latter bone.

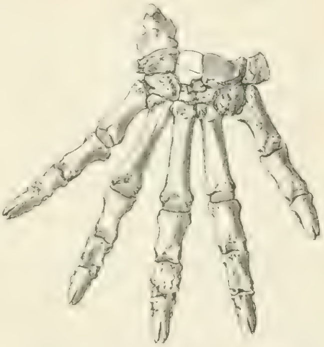

Fig. 4. *Patriofelis ferox*. Right manus, ¼ natural size.

The *lunare*, as stated above, is strongly convex from before backwards on its proximal aspect, and is closely applied to the scaphoid. Below it is strongly saddle-shaped, and articulates with the magnum, centrale and unciforme. It joins the cuneiforme by a moderately well-defined facet.

The *cuneiforme* is relatively large, and resembles the corresponding bone in the carpus of the bear. It presents a strong lateral process, which, when the bone is placed in its natural position on the unciforme, reaches over and almost touches the fifth metacarpal. The facet for articulation with the styloid process of the ulna is a wide, transversely extended groove, which is separated from the pisiforme facet by a high, transverse ridge. The distal surface has a cup-shaped facet where it articulates with the unciforme.

The *pisiforme* is robust and has a rather short, expanded tuber, which is very rugose for tendinous attachment. Otherwise this bone closely resembles that of the bear.

The *unciforme* differs from both that of the bears and felines in that it has considerably less vertical depth in proportion to its width. The cuneiforme facet is less vertical than in these forms, and the facet for the lunar is more on the summit of the bone. Distally there are two facets distinguishable, which serve as points of articulation for metacarp. IV and V.

The *magnum* is very much like that of the cat, and has practically the same relations to the surrounding bones. It is excluded from contact in front with the scaphoid by the intervention of the centrale. The broad shelf-like projection upon its radial side is occupied exclusively by the centrale, and the trapezoid does not overlap it, as is the case with the cats; in this respect it resembles the bears more than the cats. Distally it presents a single surface for articulation with metacarp. III.

The *centrale*, the smallest element of the carpus, is somewhat irregularly shaped, and articulates with the following bones: above, its principal contact is with the scaphoid, but it also touches the lunar; upon the ulnar side it articulates with the magnum, while below it is supported by the magnum and trapezoid. Upon the radial side it is more or less wedge-shaped, and lies between the scaphoid and trapezoid. In the coössified scapholunar of the cat and the bear, that prominent wedge of bone which extends down upon the radial side of the head of the magnum, and rests upon the ledge of this latter bone, undoubtedly represents the centrale.

The *trapezoid* is proportionately small, and does not lap over upon the magnum as it does in the cat. It is apparently not placed so high in the carpus as usual in the Carnivora, and therefore does not permit of the second metacarpal projecting above the level of the others, as so very frequently happens when the bones are closely articulated. It articulates above by two distinct facets with the centrale and scaphoid, and upon the ulnar side with the magnum ; upon the radial side with the trapezoid, while below it supports the second metacarpal. It has essentially the same shape as in most of the fissiped Carnivora.

The *trapezium* is chiefly remarkable for its unusual size. It is almost equal to the unciforme and greatly exceeds the corresponding bone in the carpus of the modern Fissipedia. Above it has a large facet for articulation with the scaphoid, and a smaller one by which it articulates with the centrale. Upon the ulnar side there is a facet for articulation with the trapezoid and the inner side of metacarpal II, while distally there is a rather large flattened articular surface by which it supports the first metacarpal. It is of much interest to note that in its size and general form this bone of *Patriofelis* resembles the aquatic Carnivores much more than it does any of the Fissipedia. In the sea-lion the trapezium is larger than the unciforme ; its transverse diameter is almost if not quite equal to its vertical diameter ; there is a large facet for the scapho-lunar and the facet for articulation with the first metacarpal is not convex from side to side. In the Fissipedia, on the other hand, the vertical diameter is always the greatest, the facet for contact with the scapho-lunar is relatively small, and the facet for the first metacarpal is convex from side to side. Now in *Patriofelis* the greatest diameter of the trapezium is transverse, there is a large contact with the scaphoid, and the facet for the first metacarpal is like that of the sea-lion. The corresponding bone of *Oxyæna* resembles that of *Patriofelis* very closely.

Of the *metacarpals* the third and fourth are about equal in length and the longest, after which comes the second, fifth and first in the order mentioned. In the matter of size and robustness of the shaft, metacarpal I holds the first place, although there is some reason to believe that in the specimen here figured this bone is slightly pathological, which makes it appear larger than it would otherwise be if such were not the case. In the bone of the opposite side we have unfortunataly only the proximal end preserved, so that this point cannot be fully determined. At all events it can be stated that metacarpals I and V were well developed and relatively much larger and stronger than in the Fissipedia. One noticeable feature about the metacarpals is that the interlocking is but very slightly developed, and that the foot was broad and the toes well spread apart, which would lead to the conclusion that it was webbed. The distal ends of the metapodials all possess distinct keels, which are confined to the palmar half of the articular surfaces. The dorsal portion of these surfaces present that peculiarly distinctive hemispherical pattern so characteristic of the Fissipedia, and which appears to be altogether different in the seals. No especial mention need be made of the phalanges, further than to state that they are rather broad, depressed, and slightly curved, as in the Fissipedia.

The bony *claws* differ markedly from those of the Fissipedia, in that they are not laterally compressed and pointed, as is universally the case in this group, but follow the pattern of the Creodonta in having a deep cleft at their distal extremities. So far as is known, this character appears to be a very constant one in all the Creodonts, and is one of the features by which they can be easily recognized. The claws in *Patriofelis* are not so much depressed as they are in other Creodont genera, notably *Mesonyx*, and they are, moreover, considerably curved. There does not appear to be any trace of the bony hood or sheath enclosing the base which is developed to a greater or less extent in all the modern Fissipedia. There is another feature of the claws which is worthy of note, and that is the development of the subungual process. In the sea-lion this process is so large, especially in the fore limb, that it constitutes the greater part of the bone, and there is but the faintest trace of that part which bears the corneous sheath ; yet a distinct depression upon the dorsal surface marks its position. The subungual process is not so large in the three middle digits of the hind foot, and the bony claws are well developed. In all the ungual phalanges there is a large, distinct foramen (the subungual foramen) which pierces the process transversely. This is more marked in the hind than the fore foot. In the Fissipedia, on the other hand, the subungual process is comparatively small, confined to the posterior part of the bone, and never overshadows the true bony claws, as it does in the seals. Traces of the subungual foramen exist, but they are minute and inconsiderable. In *Patriofelis* the subungual process is well developed, and extends forward, beyond the middle of the under surface of the claw, and the foramen is large and distinct, as it is in the sea-lion. In this respect the claws of *Patriofelis* are intermediate between those of the Fissipedia and the Pinnipedia.

Hind Limb.—The *pelvis* presents a number of marked anatomical characters which are apparently not found in any of the modern Carnivora at least. The ilium is well developed, and in proportion to the entire length of the pelvis exhibits about the same relative length as in the dog, cat and bear, and is therefore much greater than in the sea-lion. The chief peculiarity of the ilium of *Patriofelis* is its very unusual shape. It may be described as consisting of a strong trihedral bar of bone, the superior border of which is expanded into a broad lamina with a concave external surface. It therefore presents three distinct surfaces, of which one is directed internal, one upwards and outwards, and the other downwards and outwards. Of the two external surfaces the upper one, which served for the fleshy origin of the median gluteal muscle, is the larger and, as already stated, very concave. The inferior external surface is of less extent, and does not present any especial feature of interest further than to indicate a rather unusual size for the large gluteal muscle. The anterior end of the ilium is thickened and everted. A short distance in front of the acetabulum is seen a prominent roughened area for the tendinous origin of the *rectus femoris*. The acetabulum is rather shallow, and, as in the sea-lion, the roof of the cavity is not so thick and strong as it is in the fissiped Carnivores. It has a broad cotyloid notch, as in the dog.

The *ischium* is relatively broad and flat, with a prominent and somewhat elongated spine. There is little or no thickening of the bone at its posterior end to form the ischial tuberosities as in the Fissipedia, in this respect resembling the sea-lion. The obturator or thyroid foramen is large, slightly oval in form, and the two pubes are not united by bone at the pubic symphysis, which is long. The anterior edge of the symphysis lies considerably behind the acetabulum and not opposite its middle as in the Fissipedia. The ilio-pectineal eminence is prominent and intermediate in size between that of the dog and sea-lion.

The *femur* is large and powerful. It exceeds the tibia both in length and size. The globular head is set upon the shaft by a moderately short well-constricted neck, and exhibits a slight pit for the attachment of a *ligamentum teres*. The greater trochanter is strong and rises to a level with the head of the bone. It is roughened for muscular attachment, and has a deep digital fossa. The lesser trochanter is well developed, and is connected with the greater trochanter by a faint though well-curved intertrochanteric line. As in all the Creodonts, there is a small though distinct third trochanter. In its upper portion the shaft is flattened from before backwards, but in its lower part becomes more cylindrical, and at its distal extremity is especially thickened. The rotular groove is well developed but does not extend so high up on the shaft as in the terrestrial Carnivores. In the strictly cursorial forms, such for example as the Canidæ, the upper extremity of the rotular groove extends to a point in front of the shaft, much higher than do the condyles upon the opposite side of the bone. In the sea-lions and the seals in general the reverse of this is true. In *Patriofelis* they are about equal in this respect. The condyles are not flattened from before backwards as in the sea-lion, and there is a peculiar thickness of the bone where they join the shaft, very much as in *Hyænodon* and *Oxyæna*. Of the two condyles the inner one is slightly the longer, the disparity being about equal to that seen in the puma.

The *patella* does not present any characters of unusual importance. It may be said of it, however, that it is relatively large and rather closely resembles that of the fissiped Carnivores.

The *tibia* is shorter than the femur, and is in every way more slender and delicate. If the length of the femur be expressed by 10, that of the tibia would be 8 or thereabout. The head of the bone is relatively broad with a moderately well-developed spine. The cnemial process is not so prominent as it is in either the dog or the puma, but it is thicker and extends down the shaft for a greater distance. It is, however, much better developed than it is in the sea-lion, in which it may be said to be almost entirely absent. The distal end of the bone exhibits a strong internal malleolus, and an articular surface which shows but the faintest trace of that division into tongue and groove so highly characteristic of the higher Carnivora. The surface is directed strongly outwards.

The *fibula* is unusually stout, quite as much so as in the sea-lion, but there is no tendency to bony union with the tibia, as in the seals. The proximal end is considerably expanded and roughened for muscular attachment. The shaft is straight, nearly cylindrical and expanded into a distal extremity. When the tibia and fibula are articulated and the femur placed in position the fore and aft plane of the proximal extremity of the tibia is directed slightly inwards towards the body, while the same plane of the distal extremity is directed somewhat outwards. It results from this that the tibia has a decided twist, which causes a distinct outward rotation of the foot. In the sea-lion this torsion of the tibia is very prominent, which together with certain modifications of the tarsus does not permit the foot to be moved in a line with the long axis of the body, and gives to the animal that very peculiar and awkward gait upon the land. In the terrestrial Carnivora, on the other hand, there is no torsion of the tibia visible, and the foot moves freely in the direction of the long axis of the body. This matter will again be discussed when we come to speak of the probable habits of *Patriofelis*.

The *pes* presents a number of interesting characters. It is short and spreading in contradistinction to the narrow, elongated, compressed type of the more typical cursorial Carnivora. The *astragalus* is very primitive in that the trochlea is but faintly indicated, and the head is placed upon the body in a very oblique position. If the fibular facet be taken to indicate a fore and aft direction, then the head projects inwards at an angle of 45° or thereabout. It is nearly as great as it is in the sea-lion, and very much greater than in any of the terrestrial Carnivora. The neck is notably short and stout, and its constriction much less pronounced than is usually the case. The tibia and fibular facets form nearly a right angle at their point of junction, whereas in the sea-lion it is an obtuse angle, and in the Fissipedia it is an acute angle. The trochlea or tibial facet is rather short from before backwards, slightly prolonged upon the neck, as in the seals and *Hoplophoneus*, and with a rather prominent antero-external angle, but not so great as in the sea-lion. There is a large and distinct astragalar foramen which is placed at the posterior termination and a little to the outer side of the trochlea. This foramen, as is well known, is highly characteristic of the primitive forms of many orders of mammals, and it is of especial interest to note that the seals are among the very few living forms in which it has been retained. It is also present, though small, in the Miocene genus *Hoplophoneus*. The calcaneal facet is rather flat from before backwards, as in the sea-lion and *Hoplophoneus*, and does not have the deep saddle shape as in the Fissipedia. It is separated from the sustentacular facet by a moderately deep, wide groove. The sustentacular facet has its usual position but displays some characters peculiarly its own. It is continuous with the navicular facet by a narrow band around upon the inner side of the head, whereas in all the other forms in which these two facets are united it is always upon the outer or fibular side of the head. The facet for the navicular is oval and flattened from above downwards. While it articulates with the cuboid as well as the navicular, this articular surface is not divided.

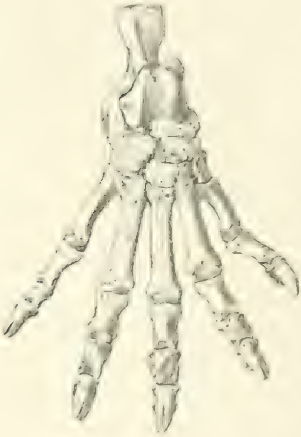
Fig. 5. *Patriofelis ferox.* Right pes, ¼ natural size.

The *calcaneum* has a short, stout tuber, somewhat laterally compressed beneath the astragalar facet, but produced into a thick more or less rounded tuberosity at its posterior extremity. The tuber is relatively much shorter than in any of the terrestrial Carnivores and approaches that of the sea-lion. The characteristic shortness of the heel in the seals is not due so much to the absolute brevity of the bony process as it is to the unusual backward prolongation of the astragalar facet, and there is in consequence a high degree of mobility of this latter bone upon the calcaneum. The astragalar facet is rather flat, and is not so steeply arched as in the dog, cat, or bear. It displays a more gentle curve, and spreads back further upon the tuber, as in *Hoplophoneus* and the sea-lion. The sustentacular facet is small, circular, and does not become continuous with the cuboidal facet, as is the case in the sea-lion. The facet for the cuboid is oval, cup-shaped, and the antero-external angle is produced in such a manner as to give it a marked obliquity in conformity with the peculiar shape of this latter bone. There is a broad, thick, ledge-like process upon the outside and near the distal end, which has generally been accepted as a mark of a plantigrade gait. In the human foot this process serves for the attachment of the annular ligament, and is deeply grooved for the passage of the long and short peroneal tendons. It is of much greater size in the calcaneum of *Patriofelis* than in that of the bear. It is also large in the sea-lion.

The *cuboid* is a highly characteristic bone in the tarsus of *Patriofelis*. Proximally it has two facets separated by a distinct antero-posterior ridge, one of which is for the astragalus and the other for the calcaneum. If the bone be held in a vertical position, the facet for the calcaneum is wholly upon the outer side, and forms the external boundary of the bone, but as the cuboid is not placed vertically in the tarsus the facet is directed upwards and outwards when the bone is in its natural position. This great obliquity of the calcaneal facet is very unusual, and is not found in any of the living forms except the seals and the South American musteline genus *Galictis*. In neither of them, however, is it so highly developed as in *Patriofelis*. Distally there is a large concave facet which supports the fourth and fifth digits. Internally it articulates by a single facet with the astragalus and ectocuneiforme. The *navicular* presents the usual form found in the Carnivora, and does not call for especial mention. The *cuneiforme* bones, moreover, display the usual pattern of the Fissipedia, the internal one not being especially enlarged, as in the seals.

The *metapodials* are five in number, and like those of the fore foot, show comparatively little interlocking. They are shorter proportionately than in the dog or cat, but are equally, if not more, robust. They are about equal to those of the black bear in length, but are stouter in every way. The fourth is the longest and strongest of the series, after which comes the third, second, fifth and first, in the order named. They all possess distinct keels and globular-shaped heads upon their distal extremities. The *phalanges* resemble those of the fore foot in their form and general proportions, with the exception of their slightly greater length. The bony claws are all fissured at their extremities, and the subungual processes and foramina are well developed.

There yet remain to be mentioned in connection with the limbs two bones which, although they were not found in position, give every evidence of being a *radial sesamoid* and a *tibiale* (?). The radial sesamoid is relatively large, and is located at the inner extremity of the scaphoid, where it is found in the dog and bear. It appears to be altogether absent in the sea-lion. It is compressed from before backwards, and is slightly hollowed out at its distal end. The *tibiale* (?) has a similar shape to that of the radial sesamoid, but is not so large and not so much flattened. It articulates by a very distinct facet with the ento-cuneiforme, very much as in the dog, and not apparently with the ento-cuneiforme and navicular, as it does in the sea-lion, in which it is unusually large.

II.—COMPARISON WITH OTHER CREODONTS.

A.—COMPARISON WITH OXYÆNA.

In the foregoing description very little mention has been made of the nearly-related genus *Oxyæna*. The species of this genus, as is well known, have been found so far only in the older Wahsatch deposits. With the aid of the materials now in the Museum Collections I am able to give a comparative statement of the more important characters in the skeletal structure of these two genera. The species upon which this comparison is primarily based is *Oxyæna lupina* Cope, of which a somewhat fragmentary skeleton was collected by the Museum Expedition into the Big Horn Basin in 1891.

In the skull of *Oxyæna* we note the same peculiarity as regards the great disparity in size between it and the rest of the skeleton seen in *Patriofelis*. The face is short, the muzzle broad and truncated, the skull much constricted behind the postorbitals, and there is a long interval between the postorbitals and the anterior termination of the brain cavity. The sagittal crest is, moreover, high and prominent and extended well forward in advance of the brain-case. There are two large postparietal foramina as in *Patriofelis*, and the glenoid cavities have anterior and posterior glenoid processes. The mastoid and paroccipital processes are prominent, and there is evidence of the existence of the same peculiar foramen piercing their posterior wall as seen in *Patriofelis*. In the lower jaw the rami are relatively deep, with a straight inferior border; the chin is abruptly rounded, the symphysis is short, the condyles well extended transversely and scroll-like in pattern; the angle is rounded and not produced into a hook, and the coronoids are broad and high.

In the teeth some important differences are to be observed, which separate the two genera very sharply. In our paper[1] we made the statement that our specimens demonstrate the existence of three incisors in the lower jaw. This, I think, is an error, for I cannot discover any evidence in support of this proposition. Cope expressed the opinion that there were only two incisors in the lower jaw, and I see no evidence for a contrary view. The dental formula, I. $\frac{2}{3}$, C. $\frac{1}{1}$, Pm. $\frac{4}{4}$, M. $\frac{2}{2}$, shows some important modifications as to the number of teeth in the molar and premolar series. In this, *Oxyæna* is the more primitive, as we would be led to infer by reason of its being the older genus of the two. *Patriofelis* has discarded one molar from the upper series, and a premolar from both the upper and lower series, if my conclusions are correct in regard to the dentition. The last lower molar has, moreover, been modified into a true sectorial tooth, consisting of only the two blades, whereas in *Oxyæna* this tooth possesses the internal cusp and the talon as well.

In the vertebral column the atlas of *Oxyæna* resembles that of *Patriofelis* very closely. The other cervicals, so far as they are known, have the same general characters as those of *Patriofelis*. The lumbars do not apparently have as highly complex zygapophyses as those of the Bridger genus, but the approach in this direction is very marked. *Oxyæna*, like *Patriofelis*, had a long and powerful tail, the sacrum being unknown.

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[1] Fossil Mammals of the Wahsatch and Wind River Beds, Bull. Amer. Mus., Vol. IV, 1892, p. 108.

Of the fore limb the scapula is somewhat fragmentary, but the greater part of both heads is preserved. The glenoid cavity has the same general form as in *Patriofelis*; as in this genus, moreover, the neck is very short, the spine rising almost immediately behind the border of the cavity. The spine itself is considerably damaged, so that the question of the acromion and the metacromion cannot be determined, but if we are to judge by the great similarity between the heads of the two bones, it is highly probable that a metacromion was present. In the humerus we note a most striking similarity. The deltoid crest is prominent and extends almost the entire length of the shaft; there is an entepicondylar foramen, but no intercondylar foramen. The humeral trochlea is very similar in the two genera, and the internal condyle is extended downwards into a broad flange-like process. The ulna has the same powerful olecranon process, and is deeply grooved, as in *Patriofelis*. Of the radius very little is known. The manus is strikingly like that of *Patriofelis*, with the exception that it is more slender and weaker in every way. In the carpus there is a free scaphoid and lunar, a centrale is present, and the trapezium is singularly enlarged, as it is in *Patriofelis*. The metacarpals have about the same relationship to each other as in the Bridger genus, and the interlocking is comparatively slight. The phalanges appear to be somewhat longer, and the claws not so deeply cleft as in *Patriofelis*. The subungual processes are well developed, and the foramen is present and large.

In our *Oxyæna* material the pelvis is not well represented, but Scott says of it:[1] "The pelvis differs from that of the typical Creodonts in having an expanded ilium, and wide, flattened ischium," a character which agrees well with *Patriofelis*. The femur appears to be a trifle shorter in proportion to its size, the distal end is more flattened from before backwards, and the rotular groove is not so well marked. There is a small, though distinct, third trochanter, and the head of the bone has a pit for the *ligamentum teres*. Of the tibia we note the same general form in the proximal extremity, with the exception of the unusually weak development of the cnemial crest, which is quite as flat as it is in the seals. In its distal extremity the astragalar facet is relatively small, but very little grooved, and not so oblique as in *Patriofelis*. The fibula is large and has the same character as in the Bridger species. The pes is remarkably similar in the details of its construction to that of *Patriofelis*. The astragalus has the same flat tibial facet; there is a large astragalar foramen, and the head is set upon the body of the bone so as to be very oblique. In the calcaneum the tuber is short, the astragalar facet is long and little arched, and the cuboidal facet is very oblique. The cuboid, moreover, shows the same remarkable oblique facet for the articulation with the calcaneum, and it also has a large facet where it joins the astragalus. The metapodials are not completely known, but what knowledge we do have of them, renders it all but certain that there are no important differences between the Wahsatch and Bridger genera. Indeed, the similarity between the limb structure of the two forms is so great that did we not know that there are considerable differences in the teeth we would not hesitate to refer them to one and the same genus.

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[1] A Revision of the North American Creodonta. Proceed. Philad. Acad., 1892, p. 315.

B.—COMPARISON WITH HYÆNODON.

This genus, as is well known, comes from the Lower Miocene or White River deposits. Although much of the skeleton has been described, very little apparently is known of the hind limb. A comparison of the skull of *Patriofelis* with that of *Hyænodon* shows some important differences, which to my mind render it extremely doubtful whether they should be placed in the same family. The general form of the skull is strikingly like that of the dog, the muzzle is long, narrow and pointed, in marked contrast with that of *Patriofelis*, which is short, broad and truncated. The skull is moderately constricted behind the orbits it is true, but the long interval between the postorbitals and the anterior termination of the cranial cavity is not found; it is about equal in this respect to the dog and the cat. The sagittal crest is not extended in advance of the brain cavity as it is in *Patriofelis*. The lachrymal is extended out upon the face, as was noted by

Scott,[1] a character which is not found in *Oxyæna* at least. The anterior glenoid process is wanting, the mastoid is much reduced, and there is a post glenoid foramen present. The mandibular condyles have comparatively little lateral extension, and the angle of the jaw is produced into a blunt hook-like process, which has a strong inclination inwards. The rami are long, shallow and much curved upon the inferior border; the chin is long and pointed, and the symphysis singularly elongated. These characters stand out in bold relief from those already noted in *Oxyæna* and *Patriofelis*.

In the dentition again there are three incisors in the lower jaw as well as three true molars, whereas both *Patriofelis* and *Oxyæna* have only two. In the fore limb the scapula is unknown, the humerus has the usual Creodont characters, which may also be said to be true of the ulna and radius. The carpus differs from that of *Patriofelis* and *Oxyæna* in the proportions of some of the bones, but in the enlargement of the trapezium it resembles them. In the hind limb the ilium is said by Scott (l. c.) to be feline in appearance and to have the gluteal surface little expanded. He also describes a large contact between fibula and calcaneum. The transverse processes of the atlas are also stated by this author to be imperforate.

These characters, it seems to me, weigh strongly against the conclusion that there is any near relationship between *Hyænodon* and either *Patriofelis* or *Oxyæna*, as is believed by Scott. *Hyænodon*, moreover, is the most modern of all the Creodonts, and if it has been derived from *Oxyæna* it must have been from a species much more primitive than any yet known belonging to that genus. I think it much more probable that *Stypolophus* was the ancestor of *Hyænodon*, since in this form we have all the conditions satisfied, so far at least as we know its osteology. This cannot be satisfactorily determined, however, until we know the Uinta representative of the White River Creodont.

C.—COMPARISON WITH PALÆONICTIS.

There is but one other family with which it is necessary to compare *Patriofelis*, and that is the Palæonictidæ. Unfortunately we know very little of the osteology of either of the two genera composing this family. They are both short muzzled types, and in one at least (*Palæonictis*) there was a full complement of incisors in the lower jaw. The upper molars do not exhibit the sectorial pattern of either *Oxyæna* or *Patriofelis*, and it is highly probable that they form a distinct family. I have elsewhere[1] called attention to their relationship with the Felidæ.

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[1] Some Little-known Creodonta, Journal Philad. Academy, Vol. I, 1886, p. 177.

III.—COMPARISON WITH THE SEALS.

It yet remains to compare the skeleton of *Patriofelis* with that of the modern Pinnipedia. This group, as is well known, is the most distinct and aberrant of all the Carnivora. The large number of trenchant anatomical characters by which they are distinguished from their nearest allies is strong presumptive evidence of the fact that their ancestry is to be traced far back into Tertiary times. It is moreover highly probable that much of the extreme modification by which they are now characterized will not be found to pertain to their ancestors, inasmuch as no Creodont or primitive Carnivore is known whose limb structure would lead one to suppose that it was exclusively aquatic, as the seals now are.

There is, however, much evidence to convince us, as I will presently attempt to show, that this group at least of Oxyænidæ included animals accustomed to seek their food in the water, and were partially adapted to an aquatic life.

The *principal osteological characters* of the Pinnipedia may be briefly summarized as follows:[2] In the *skull* the face is remarkably short, the interorbital constriction pronounced, and there is a long interval between the anterior termination of the brain and the postorbital processes when they exist. There is no lachrymal bone or canal, and there is a large vacuity in the inner wall of the orbit. The brain-case is broad, and in the least specialized forms is surmounted by a high and prominent sagittal crest, which extends forwards to the postorbitals. There may or may not be an alisphenoid canal or an anterior glenoid process present. The mastoids are conspicuous, and the tympanic bullæ are either conspicuous and inflated or small and rugged. There is no postglenoid foramen. The teeth have an unusually simple pattern. The true molars are never more than two, and the entire molar and premolar series never consist of more than six teeth. The incisors in the lower jaw of both the temporary and milk series never exceed two pairs. The *vertebræ*, in some of them at least, show marked traces of the complex articulations of the pre- and postzygapophyses of the lumbar region, so common in the Creodonts. The *feet* are pinniform, with the digits of the manus decreasing in length and size from the first to the fifth ; the true ungual processes of the ungual phalanges are either distinct and terminal or altogether abortive, in which case, they are replaced by subungual processes, which are always large, the first three being pierced by a foramen. The trapezium is as large or larger than the unciforme ; the ulna has a powerful and elongated olecranon process ; the humerus is shorter than the scapula, and has an enormous deltoid crest which extends nearly the whole length of the shaft ; the entepicondylar foramen is either present or absent. The scapula is broad with a well-developed supraspinous fossa, and a short neck and rudimental metacromion process.

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[1] Fossil Mammals of the Wahsatch, Bull. Amer. Mus., Vol. IV, 1892, p. 96.

[2] See Prof. J. A. Allen's 'Monograph of the North American Pinnipeds.' U. S. Geol. Survey, F. V. Hayden, 1880, a most important work; also 'The West Indian Seal,' *Monachus tropicalis*, by the same author. Bull. Amer. Mus., Vol. II, 1887, pp. 1–34.

In the *pelvis* the ilia are short with the anterior border much everted ; the pubes barely meet in a short symphysis which lies behind the acetabulum and is never anchylosed. The cotyloid notch is much reduced or altogether absent, and there is no pit for the *ligamentum teres.*

The *femur* is remarkably short, much compressed from before backwards, the digital fossa is small or absent, and there is no third trochanter. The fibula, which is large, is coössified with the tibia ; the cnemial crest is weak or absent, and the tibia has a very decided twist. The tibia-astragalar facet is plane, without the tongue and groove of the Fissipedia ; in some of them at least (*Zalophus*) there is a vestigial astragalar foramen present. The tuber of the calcaneum is short; there is large contact between the astragalus and cuboid, and the calcaneo-cuboidal facet is very oblique, as in *Patriofelis* and *Oxyæna.* To this should be added the large size of the external calcaneal tubercle. In the pes the first and fifth digits are the largest, with the three middle ones shorter and subequal. Of the ungual phalanges the subungual processes are well developed and perforated by the subungual foramen.

The Pinnipedia are divided into three families, of which the Otariidæ are in many respects the most primitive. This is seen more especially in the characters of the hind limbs, which can support the body in the ordinary way, and can be used to a considerable extent for progression upon the land, whereas in the more typical seals (Phocidæ) this is not the case. Other characters which cause them to be regarded as the most primitive members of the group are seen in the presence of postorbital processes, the high sagittal crest, an alisphenoid canal, an anterior glenoid process, small and rugged tympanic bullæ, a prominent mastoid process, a rudimental cotyloid notch of the acetabulum, presence of trochanter minor of the femur, and a more normal astragalus, which frequently shows distinct traces of the astragalar foramen. They are more specialized than the Phocidæ in the following characters: absence of entepicondylar foramen of humerus, rudimental condition of the true ungual processes in all the digits of the manus, absence of digital fossa of femur, which however is not found in all the Phocidæ, and lack of complication of the lumbar zygapophyses.

From a careful survey of the foregoing osteological characters of the Pinnipedia, in connection with what we already know of the development of the Carnivora from the Creodonta, I think that the following propositions may be fairly deduced: (1) *They are descended from ancestors in which the tibia-astragalar facet was not grooved*, for the reason that there is no Carnivore known in which the groove has ever been obliterated when once formed.[1] The ungrooved astragalus is characteristic of all the Creodonta, with the exception of one family, Mesonychidæ. (2) *They are descended from a short muzzled type in which there was great reduction of the true molars, and comparatively little reduction of the*

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[1] Even in such an exclusively aquatic form as the sea otter the astragalar groove is very distinct, notwithstanding the fact that the digits of the pes are highly modified.

premolars, for the reason that there are never more than two true molars and very frequently one.[1] (3) *They are descended from a type in which the incisors of the lower jaw were reduced to two pairs.* This proposition I regard as established from the fact that none of them possess more than the two pairs in the lower jaw in the adult dentition, and according to Allen,[2] there are only two pairs of incisors in the lower jaw in the milk dentition of the Otariidæ, which seems to point to the fact that they were lost at an extremely early period. (4) Their ancestors possessed in addition the following important characters: Skull with interorbital region constricted and long between postorbitals and the anterior termination of the brain-case; an alisphenoid canal; an anterior or preglenoid process; a prominent mastoid; a metacromion process of the scapula; an entepicondylar foramen of the humerus and a prominent deltoid crest; a long and powerful olecranon; an enlarged trapezium; a free scaphoid, lunar and centrale; a short unanchylosed pubic symphysis; a femur with a digital fossa; an unreduced fibula; an astragalar foramen; a cuboid with a very oblique facet for the calcaneum and a large contact with the astragalus; a calcaneum with a relatively short tuber and ungual phalanges, with well-developed and large, perforated subungual processes. (5) Their ancestors were, judging from these characters, not exclusively, but semi-aquatic in habits, with limbs fitted for progression upon the land.

If now we examine the skeleton of *Patriofelis* in connection with these probable ancestral characters of the seals, we find that there are some striking features of likeness between the two groups. These characters, moreover, are found in such widely different parts of the skeleton, that I think they can hardly be due to convergence or parallelism.

Features common to Patriofelis and the Seals.—In the *skull* we note the *short muzzle* and long much-constricted region between the postorbitals and the anterior termination of the brain-case; there is an alisphenoid canal present, as well as a well-developed preglenoid process; the mastoids are prominent in both, and there is no postglenoid foramen. There are but two pairs of incisors in the lower jaw, and the molar dentition is much reduced. In the fore limb the humerus is shorter than the scapula, and provided with a great deltoid crest and an entepicondylar foramen. The scapula is large, with short neck and metacromion process. The ulna has the same powerful olecranon, which, together with the prominent deltoid crest, however, appears to be very common among the Creodonts. The trapezium is enlarged ; the feet are broad and spreading, and in the ungual phalanges, the subungual processes are largely developed.

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[1] See Huxley's 'Anatomy of Vertebrate Animals,' p. 363.

[2] Loc. cit., p. 3.

In the vertebral column, as already noted, some of the seals (notably *Phoca vitulina*) show marked traces of the complex articulation of the lumbar zygapophyses. The pubic symphysis of *Patriofelis* is short, lies behind the acetabulum, and is not anchylosed. The fibula is large and unreduced in both groups ; the trochlea of the astragalus is not grooved ; the tuber of the calcaneum is short, and the cuboid has a very oblique calcaneal facet and a large contact with the astragalus. The foot is broad and spreading, and the ungual phalanges have perforated subungual processes.

PROBABLE HABITS OF PATRIOFELIS.

From the structure of the limbs more than any other feature in the osteology of *Patriofelis*, I am led to conclude that it was aquatic or semi-aquatic in habits. The broad, flat, plantigrade feet, with their spreading toes, suggest at the first glance their use for swimming. The eversion of the feet, together with the general clumsiness of the limbs, point, moreover, to the fact that the animal was not an active runner. Now, if the animal was aquatic, what was the nature of its food ? It certainly could not have been fish, for the reason that the remains of fishes are very scarce in the Bridger sediments. If, however, we can form any judgment from their remains, I think that it can be safely stated that the Bridger Lake *literally swarmed with turtles*, and if *Patriofelis* frequented the water, it is highly probable that they formed a staple article of its diet. This supposition accords well with the great strength and power of the jaws, together with the robust and much-worn condition of the teeth. There is another fact which may be mentioned in this connection, which has a direct bearing upon this conclusion, and that is the existence of coprolites in the Bridger sediments containing fragments of turtle shells. This, while it is not at all conclusive, yet demonstrates that there was an animal living on the borders of the ancient lake, that was accustomed to capture turtles for food, and from what has already been stated, I think that animal was *Patriofelis*. He was, perhaps, not as expert a swimmer as the seals now are, but was sufficiently active in the water to capture turtles. When the lake disappeared, it can be conjectured that *Patriofelis* took to the open sea, and finally came to feed upon fish exclusively. It is further conceivable that in their new habitat their swimming power was gradually increased, and, owing to the soft nature of their food, the great strength and power of the jaws were gradually lost, and the teeth became gradually modified into the simple degenerate organs which constitute the dental equipment of the modern Pinnipedia.

IV.—CLASSIFICATION AND SPECIES OF PATRIOFELIS.

It will be seen from what has already been stated that *Patriofelis* is a member of the Creodonta. Various efforts have been made from time to time to give an exact definition of this group, but these definitions have as yet proven very unsatisfactory. That the Creodonta stand in general antecedent relationship to the Carnivora is now abundantly demonstrated, but whether the Carnivora arose from one or several stems of the Creodonta, is still an open question. It is held by Cope and Scott that all the Fissipedia are descended from the Miacidæ of the Credonta. I have expressed a contrary opinion, with Schlosser, in regard to the cats.

One of the chief osteological distinctions between the Creodonta and the Carnivora consists in the union of the scaphoid, lunar and centrale in the carpus of the Carnivora, whereas they are free in the Creodonta. There are, moreover, such characters as the fissured ungual phalanges, the complex articulations of the lumbar vertebræ, the relative size and degree of convolution of the cerebral hemispheres, and a number of other characters of less importance which serve to distinguish these groups from each other. It must be borne in mind, however, in considering these differences, that if the Carnivora have been derived from the Creodonta, the distinctions between them must have been exceedingly slight at the point where they actually meet, and that any definition which can be given will, according to the very nature of the case, fail. There is considerable evidence to show that wherever the Creodonta continued beyond the Lower Miocene they took on certain characters which now so sharply distinguish the Carnivora. In the Miocene genus *Hyænodon*, the cerebral hemispheres were almost, if not quite, as well convoluted as their carnivorous cotemporaries, and in the European species of the same genus, according to Scott, the scaphoid, lunar and centrale were united as well. In a like manner many of the Miocene Carnivora show marked traces of their Creodont ancestry. This is especially seen in the flat astragalus and the remains of the suture uniting the scaphoid and the lunar, as well as the simpler type and less convoluted cerebral hemispheres. It would appear, therefore, that these groups, being incapable of exact definition, have lost much of their original significance, and are now to be regarded as mere matters of convenience in classification. The same may be said of the Insectivora with relation to the Creodonta.

The systematic position of *Patriofelis* within the Creodonta is not difficult to discover. Its general skeletal structure is so much like that of *Oxyæna* that, notwithstanding the differences in the teeth, they must be placed in the same family. *Oxyæna* is the older form, and has the more primitive dentition, but the differences are not greater than we would be led to anticipate in the ancestral genus. I think that it can be accepted as demonstrated that *Patriofelis* is the direct descendant of *Oxyæna*, which may have likewise given off a branch which terminated in the modern seals. It is somewhat doubtful whether this branch leads through *Patriofelis.*

Regarding the relationship of *Patriofelis* to *Hyænodon* I have spoken on a former page. I do not think that they can be consistently associated in the same family.

The family definition may now be stated as follows :

Oxyænidæ.—Muzzle short and truncate ; interorbital region constricted and elongated ; sagittal crest extended well in advance of the brain-case. A preglenoid process and no postglenoid foramen ; an alisphenoid canal and prominent mastoid. Lachrymal bone not extended out upon the face. Two pairs of lower incisors. Trapezium enlarged ; pubic symphysis not anchylosed ; fibula unreduced ; calcaneo-cuboidal facet very oblique ; cuboid having large contact with astragalus. Fibula not articulating with calcaneum.

Oxyæna Cope.—Premolars in the lower jaw 4, molars 2. Last superior molar transverse.

Patriofelis Leidy.—Premolars in lower jaw 3 ; molars 2, Last superior molar longitudinal.

The species are not numerous, and it is indeed questionable whether more than three should be referred to *Patriofelis.* Leidy's type species *P. ulta* is easily distinguished by its small size ; it is scarcely more than half as large as *P. ferox.* I have chosen to regard Cope's species *P. tigrinus* as distinct chiefly on account of its having come from an older formation, although there is no character observable in the fragmentary specimen of *P. tigrinus* to warrant such a belief. When we have better specimens of it, however, it will doubtless show a nearer relationship to *Oxyæna* than to the Bridger species. There is yet another species which was described by the writer[1] under the name of *Patriofelis leidyanus.*[2] It was stated at the time that its reference to the genus *Patriofelis* is doubtful. I am now convinced that it does not belong here, but is probably a forerunner of the Miocene Nimravidæ. Until more of it is known it is impossible to give to it a generic definition, and I therefore refrain from proposing a new name.

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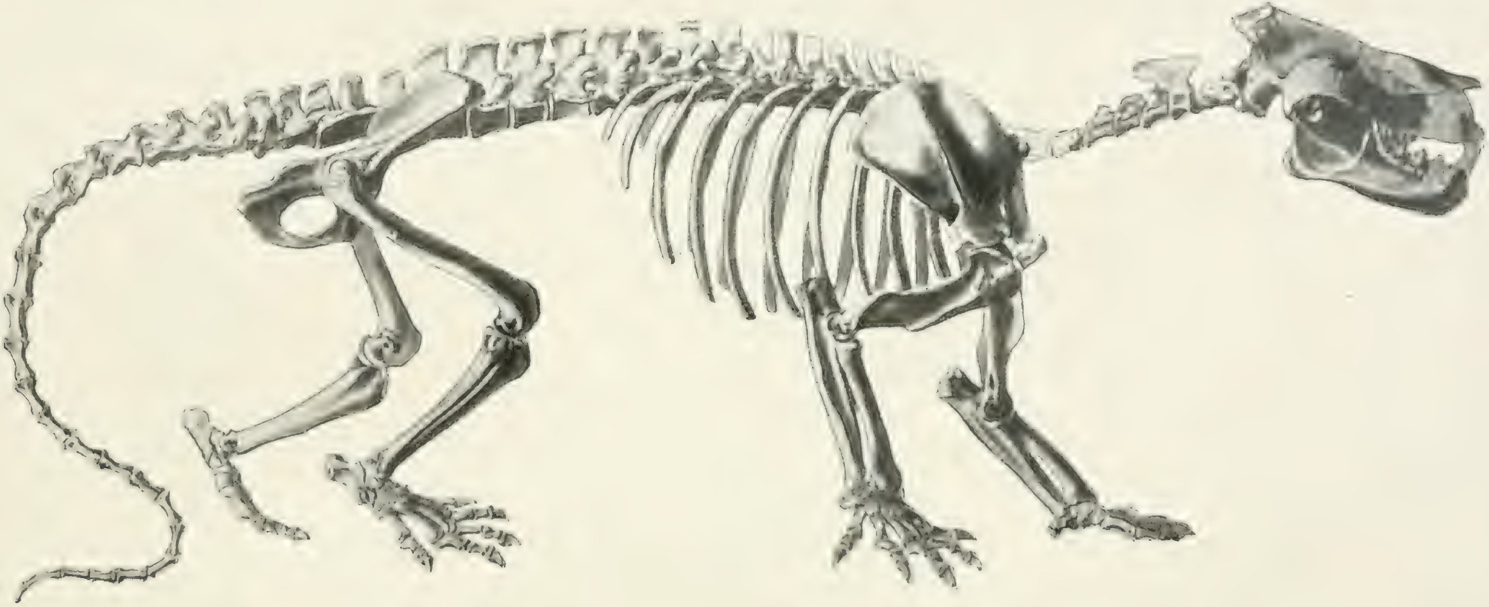
[1] Fossil Mammals of the Wahsatch, Bull. Amer. Mus., Vol. IV, 1891, p. 98.

[2] This species, together with the figure of it, is erroneously attributed by Zittell, in his 'Handbook of Palæontology,' to Osborn.



RESTORATION OF PATRIOFELIS FEROX

1/8 Natural Size.

Article VI. — ON THE MAMMALS OF ARANSAS COUNTY, TEXAS, WITH DESCRIPTIONS OF NEW FORMS OF LEPUS AND ORYZOMYS.

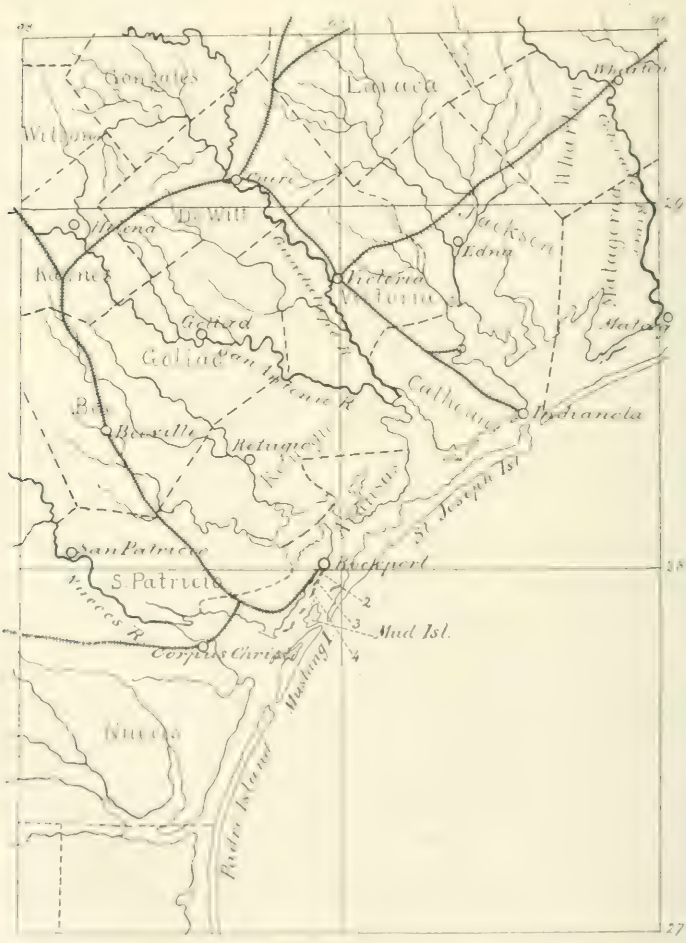
By J. A. Allen.

The following paper on the mammals of Aransas County, Texas, is based on a collection made by Mr. H. P. Attwater during the years 1892 and 1893. The collection numbers about 300 specimens, representing 24 species, in most instances by good series of both young and old. About three-fourths of the specimens have been purchased by the Museum, the rest being reserved by Mr. Attwater for his private collection. They have all been kindly forwarded to the Museum for study, and I am further indebted to Mr. Attwater for the valuable field notes presented in the following pages.

The present collection is especially interesting from having been gathered from a very limited area, for the most part within a radius of ten miles of the town of Rockport. As shown on the accompanying map, Aransas County consists of a number of small islands and of several irregularly shaped peninsulas formed by the extension inland of various bays. The specimens were collected partly on the mainland, on marshy ground in the immediate vicinity of Rockport, and partly on the adjoining small islands numbered 2, 3 and 4 on the accompanying map. They doubtless fairly represent the mammalian fauna of this very limited area, but probably a number of additional species occur in other parts of the county. These would probably include a number of additional species of Bats, perhaps one or two Shrews, and a Harvest Mouse (*Reithrodontomys*). No species of Kangaroo Rat was met with, and Mr. Attwater is very confident that none occurs within the area covered by his explorations.

As marked changes have already occurred in the mammalian fauna of Aransas County since its settlement, it has seemed desirable to include in the list a few species that have already become nearly or quite extirpated. The total number of species is thus increased to 36, about ten being given solely on the basis of Mr. Attwater's notes.

The notes kindly furnished by Mr. Attwater are here given in substance, and generally in his own words. Although sometimes condensed and somewhat changed in form, it has been thought best to present them as though they were direct quotations from


Gonzales
Lavaca
Wilson
Wharton
Cuero
De Witt
29
Helena
Jackson
Edna
Karnes
Victoria
Victoria
Goliad
Goliad
San Antonio R
Matagorda
Calhoun
Indianola
Bee
Beeville
Refugio
St Joseph Isl
San Patricio
Rockport
28
S. Patricio
Nueces R
2
3
Mud Isl.
4
Corpus Christi
Mustang I.
Nueces
Padre Island
27

Map of Aransas and Adjoining Counties.—The collection was made chiefly on the small islands numbered 2, 3 and 4, and on a low, marshy point close to the island marked 1, sometimes referred to in Mr. Attwater's notes as the 'Point' or 'Pocket.

his notes and letters, and to further distinguish them by his initials. They include also the following paragraphs respecting the general character of the area in question.

"Aransas County, with Rockport as the county seat, lies on the Gulf coast of Texas, between the Guadaloupe and Nueces Rivers, and about half way between Galveston and the mouth of the Rio Grande. It comprises an area of 437 square miles, and includes Live Oak, St. Charles and Lamar Peninsulas, and St. Joseph Island, which latter extends along the Gulf for 28 miles; the remainder of the county is made up of Aransas, Copano, Puerto, and St. Charles Bays, in which are situated a number of shell reefs and small islands.

"The prevailing tree growth on the peninsulas consists of dwarfed live oaks, 'sweet bay' (*Persea carolinensis*), and 'huckleberry' (*Vaccinium arboreum*), with scattered groups of anaqua (*Eluetia elliptica*), hackberry, mezquit, and prickly ash. The shell ridges along the shores and on St. Joseph and the smaller islands are covered with a tangled growth of 'chaparral,' consisting chiefly of dwarfed persimmons, huisache and 'cat-claw,' with patches of dewberry vines and occasional bunches of prickly pear (*Opuntia*). On St. Charles Peninsula is a considerable area of black-jack oaks.

"Along the shores is a belt of comparatively open country, of an average breadth of half a mile, covered with a dense growth of weedy plants, the most common being 'wild sage' (*Croton texensis*), *Eupatorium*, *Cassia*, *Baptisia*, *Helenium*, and *Amphiachyris*. On the salt flats *Statice* and *Lycium* grow in abundance. The most common grasses on the uplands are Bermuda and burgrass (*Cenchrus tribuloides*).

"Back in the interior the vast mezquit lands of the West meet the black 'hog wallow' prairies, which extend along through the coast counties from Louisiana into southeastern Texas.

"'The narrow belt of the Tropical Realm, which extends northward along the Texas coast from the Lower Rio Grande,' begins to disappear in Aransas County, and probably dies out in Calhoun County, adjoining Aransas on the east, the northern limit being near the mouth of the Guadaloupe River. About here

I think will be found the extreme limit in southern Texas of the range of such southern birds as the Vermillion Flycatcher, Chaparral Cock, Cactus Wren, Paraque, White-tailed Hawk, and some others."

1. **Didelphis marsupialis californica** (*Bennett*). TEXAS OPOSSUM.—Represented by three adult specimens, taken Jan. 10, Feb. 5 and Feb. 10. Two of these agree with three others from Corpus Christi and another from Brownsville in the surface of the pelage being black; the other specimen differs in having a very full covering of long pure white bristly hairs, which largely conceal the blackness of the finer pelage below.

In the absence of specimens from the supposed type locality of Bennett's *Didelphis californica* (P. Z. S., 1833, p. 40), said to be "from that part of California which adjoins Mexico," I follow Professor Baird in referring to this form the Texas series of Opossums. The Texan animal, as represented in the coast region of Texas, differs from the northern *D. m. virginiana* not only in the generally much darker color, but in the presence of a well-defined blackish eye-stripe and wholly black feet. In a series of 24 specimens from the vicinity of New York City the whole head is much lighter (nearly white), the eye being merely surrounded with a dusky border, most developed in front of the eye; there is also no eye-stripe nor median frontal stripe as in the Texas specimens. The apical portion of the toes of both fore and hind feet is white, as a rule, the white, however, varying in extent, being sometimes limited to the terminal phalanx, and sometimes involving the greater part of the foot. In Texan specimens the black also extends much further on the tail, involving the basal third or half, or even more, instead of being confined to the extreme base, as in northern examples; and the tail is also very much longer.

"Opossums are very common all over the peninsulas of Aransas County, and I think also on St. Joseph Island. They frequently come into town at night after chickens, and during summer, when the doors and windows are open, enter houses and explore the premises. One was caught lapping milk that had been left on a table in a kitchen. Several were sent to me that had been killed in and near a house on the outskirts of town. They vary considerably in color, but none are very light."—H. P. A.

2. **Tatusia novemcinctus** (*Linn.*). NINE-BANDED ARMADILLO.—One specimen, St. Charles Peninsula, 20 miles northeast of Rockport, Oct. 1, 1893.

"Armadillos are found in several parts of Aransas County. The one sent is from St. Charles Peninsula, where I have heard of a number being seen. This is probably about the limit of their range to the eastward along the Texas coast."—H. P. A.

3. **Lepus callotis** *Wagler.* JACKASS HARE.—Represented by six specimens, including adults in both summer and winter pelage, and also young of various ages, from one apparently only a few days old (collected Oct. 11, 1893) to others half to two-thirds grown.

There appears to be no appreciable difference in coloration with age. There is, however, a marked seasonal variation. Summer specimens have the pelage much shorter, thinner, and somewhat lighter in color (less fulvous and grayer) than winter specimens, with a broad, long (about 75 by 35 mm.) jet black nape patch of fine, short fur, usually divided posteriorly by a narrow stripe of gray, formed by a slight tipping of gray to the black hairs. This stripe varies in extent and distinctness in different specimens. In full winter pelage the black nape patch is wholly wanting, and the general pelage is much fuller, longer, and more strongly fulvous.

Mr. Attwater gives the weight of two adult specimens as follows: ♀, Nov. 8, 6 lbs. 6 oz.; ♂, Sept. 18, 6 lbs. The length of the hind foot in each of these specimens is given on the label as 5.25 in. (= 133 mm.).

Two other specimens collected by Mr. Frank M. Chapman[1] at Corpus Christi, April 16 and 25, and hence in short summer pelage, are evidently referable to the same form.

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[1] Mr. Chapman collected at Corpus Christi from March 18 to April 25, 1891. His report on the birds he collected has already been published (this Bulletin, Vol. III, pp. 315–328), as have his notes on two of the mammals (l. c., pp. 284, 285, and 288, 289). Further frequent references will be made to the mammals in the present paper.

These specimens are all provisionally referred to *Lepus callotis*, originally described from some part of Mexico, of which Dr. Mearns's *Lepus melanotis*,[1] from Kansas and Oklahoma Territory, seems to be merely a larger, rather more fulvous northern subspecies.

"Jack Rabbits are common all over the country, and do considerable damage to gardens. Many of the smaller truck farms are surrounded by rabbit-proof fences for protection from their depredations. The State passed an act two years ago (1892) placing a bounty on them, and they have now become much scarcer. They are also sold in the poultry and game shops, being brought to town from a distance by Mexicans and others. I understand that the bounty was removed at the last session of the legislature, some of the southwestern counties of the State not having money enough to pay the bounties on these and other animals included in the act.

"Jack Rabbits are now very common on St. Joseph Island, where I am told they were introduced during the late war.

"These animals are sometimes taken young and kept alive; but they are always wild and very pugnacious. The species appears to breed at any time, its food being easily obtainable at all seasons. I think they have only one young at a time."—H. P. A.

4. **Lepus sylvaticus bachmani** (*Waterh.*). TEXAN WOOD HARE.—Eleven specimens of this form of the Wood Hare are contained in Mr. Attwater's collection, and eleven in Mr. Chapman's Corpus Christi collection. Among the former are three one-fourth to one-third grown, taken respectively Feb. 26, March 20, and July 24. There seems to be very little seasonal variation in color.

This is a well-marked form of the *sylvaticus* group, distinguished by its very small size and the clearer, whitish gray of the sides and rump. I follow Baird in identifying it with the *L. bachmani* of Waterhouse, assuming, with him, that the original specimen was in all probability a part of the "Texas collections of Douglas"—a probability our present knowledge of the southwestern forms of the group (*arizonæ*, *auduboni*, etc.) greatly strengthens. Although this is a light-colored form, it does not present the kind of pallor shown by the pallid forms of the interior.[1]

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[1] Bull. Am. Mus. Nat. Hist., II, p. 297, Feb., 1890.

"All the specimens are from the mainland, where they are not uncommon. I have not found them on the islands, but I am not sure they do not occur there."—H. P. A.

[**Lepus aquaticus** *Bachman.*—Represented by two specimens taken by Mr. Attwater at San Antonio in April, 1891, and one taken May 8, 1894, but there are none in the Aransas County series. I am, however, indebted to Dr. C. Hart Merriam for specimens kindly loaned for examination from Matagorda and the lower Brazos River, showing that the species extends southward from Louisiana along the Gulf coast nearly to Aransas County. The San Antonio specimens are much lighter colored than Dr. Merriam's coast specimens, which do not appear to differ from Louisiana examples.]

5. **Geomys personatus** *True.*—Represented by a series of about 50 specimens, taken nearly throughout the year, only the months of June, July and August being unrepresented.

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[1] An examination in this connection of numerous specimens of the *sylvaticus* group from various parts of North America shows that it stands in need of careful revision. It is an exceedingly plastic group, its representatives varying greatly in size, in color, and particularly in the size of the ears, at different localities. While the material for its satisfactory revision is lacking, I take the present opportunity to characterize a form which attracted my attention many years ago, and was even still earlier referred to by Professor Baird (Mam. N. Am., 1858, p. 599)—namely, a large form from Iowa, Wisconsin and Minnesota, which I propose to call *Lepus sylvaticus mearnsii*, in honor of Dr. E. A. Mearns, U.S.A., on whose large series from Minnesota this subspecies is now primarily based.

Lepus sylvaticus mearnsii, subsp. nov.

Distinguished by its large size and rather pale colors, in comparison with true *sylvaticus* of the East, its nearest ally. The dorsal area is not nearly so dark brown, and the sides of the body are much paler.

Ten specimens from Fort Snelling, Minn., measured in the flesh by Dr. Mearns, average as follows: Total length, 475 mm. (18.74 in.); head and body, 418 mm. (16.45 in.); tail vertebræ, 66 mm. (2.60 in.); hind foot, 105 mm. (3.95 in.). This is about two inches longer in total length than the average of specimens from New York and Massachusetts, while the hind foot is about .30 in. longer.

Compared with the Texas series above mentioned the difference is still more striking, both in respect to coloration and size. Nine Corpus Christi specimens, measured in the flesh by Mr. Chapman, average as follows: Total length, 431 mm. (16.97 in.); tail vertebræ, 45 mm. (1.77 in.); hind foot, 79 mm. (3.11 in.).

Type. No. $\frac{4183}{3198}$, ♂ ad., Fort Snelling, Minn., March 29, 1891, Dr. E. A. Mearns.

This form is somewhat parallel in its large size and peculiar tints with *Tamias striatus griseus* Mearns, *Tamius quadrivittatus neglectus* Allen, *Sciurus carolinensis hypophæus* Merriam, and other forms from the same region yet to be separated.

"This Gopher is very common in Aransas County, especially in that part of the peninsulas between the bay and the edge of the brush. There is hardly a square foot of this belt of land (half a mile to a mile in width), where the soil is sandy and there are few or no trees or brush, that has not been plowed over many times by these animals. I think they have done much towards fertilizing this particular region, and that the wonderful vegetable growth on the knolls and open places on Live Oak, St. Charles and Lamar Peninsulas, can be attributed to this cause.

"Like the Moles, they do not throw up many mounds in summer—from May to September—and probably for the same reason, namely, the abundant food supply of bulbs, roots, etc., which can readily be found within a few feet of their nests. Later they burrow more extensively in search of food. They are particularly destructive to young fruit trees. A farmer on St. Charles Peninsula told me he killed over 250 of these animals between the 18th of March and the middle of April, 1893. They were eating off his young mulberry and pear trees at the roots. The orchard had been set out in an old sweet potato field, and sweet potatoes came up all over it from potatoes left in the ground the previous year. These no doubt attracted the Gophers, as they are particularly fond of sweet potatoes, and are thus a great nuisance to farmers and gardeners.

"Gophers, Pocket Mice and Moles frequent the same localities. I found none of either on any of the islands. They do not take to water, as do the Cotton Rats, Rice-field Mice (*Oryzomys*), Raccoons, etc."—H. P. A.

6. **Perognathus paradoxus** *Merriam.* TEXAS POCKET MOUSE.

Perognathus fasciatus BAIRD, Mam. N. Am. 1857, 420 (at least in part; not *P. fasciatus* WIED); THOMAS, P. Z. S. 1888, p. 449 (Duval Co., Texas).

Perognathus paradoxus MERRIAM, N. Am. Fauna, No. 1, Oct. 1889, p. 24 (Trego Co., Kansas).

Perognathus paradoxus spilotus MERRIAM, N. Am. Fauna, No. 1, Oct. 1889, p. 25 (Gainesville, Cook Co., Texas); ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 225, April, 1891 (Padre Island and Bee Co., Texas).

This species is represented by 22 specimens, including both sexes and various ages. One was taken in January, 2 in March, 2 in May, 5 in October, 6 in November, and 6 in December.

The adult specimens vary little in color, although some are of a rather stronger shade of reddish yellow than others. Immature examples are darker, with a finer, much softer pelage. They appear to agree perfectly with specimens of corresponding age from Brownsville, Texas.

A large series of adults from Brownsville, taken mostly in August and September, are not comparable as to season, being in thin summer pelage. They are much darker and much less hispid than the Rockport series. An October specimen (No. 4195, ♂ ad.) from Brownsville, however, in nearly full winter coat, is scarcely distinguishable from Rockport examples of corresponding date. Another October Brownsville specimen (4196, ♀ ad.) is less advanced, but plainly indicates a winter pelage like that of the Rockport series.

If separable from the Kansas type (true *paradoxus*), these specimens would all be referable to the *P. paradoxus spilotus* form. The distinctness of the dusky spot on the anterior border of the ear externally is variable, and the whole fore leg is often white instead of tan-colored to the wrist.

"This species is very common in open places, and sometimes where there are bushes. Although found near the shores, I have never met with it on any of the islands. It may, however, occur on St. Joseph Island.[1] Its favorite haunts are the higher knolls in the low flats around the bays. Its chief food in fall and winter is the seeds of the sage weed (*Croton texensis*), which grows in great abundance all over the open country, and affords food for many of the seed-eating mammals and birds. In the spring, when the sage seed becomes scarce, the Pocket Mice take to the seeds of the bur-grass (*Cenchrus tribuloides*), which grows all over this region. On March 29 I caught a half-grown Pocket Mouse with its cheek-pouches filled with these burs. In digging out one of their burrows, probably an old Gopher burrow, I found the bottom of the burrow, for a distance of thirty-five yards, covered with grass burs.

"There are several holes or entrances to each of their homes or nests. The earth removed in excavating them is piled in a single mound several feet away. After going into a hole they fill the dirt in behind them, thereby stopping up the entrance, doubtless for the purpose of keeping out snakes. I have never found any nest; perhaps they do not make any, but merely lie in the sand. While they do not appear to lay up large stores, they probably gather food during the night to eat in their holes, laying up a larger quantity for 'northers' or cold spells. They occasionally drag in rubbish with which to close their holes. I once found the wing of a plover dragged into a *Perognathus* hole.

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[1] There are two specimens in the Museum Collection from Padre Island.

"An old female taken March 31 contained nine very small embryos, but I have never met with any newly-born young. As they eat grass roots, etc., as well as seeds, food is abundant, and they breed early, and probably several times a year.[1] They can be caught in traps baited with oatmeal, and also by placing traps over their holes, so that they are caught in going in or out."—H. P. A.

7. **Mus decumanus** *Linn.* BROWN RAT; WHARF RAT.—"Captain Bailey, Captain Phillips, and several other old settlers say that 'Barn Rats' or 'Wharf Rats' were abundant fifteen to twenty years ago, but that they gradually disappeared after the great beef packing establishments closed up, and the marine shipping ceased upon the advent of the railway into this region. I do not believe there is at present a Brown Rat in Aransas County. I failed to find one during my two years' residence there, in 1892 and 1893."—H. P. A.

Mr. Chapman secured a very large specimen of this species in the vicinity of Corpus Christi.

8. **Mus alexandrinus** *Geoffr.* WHITE-BELLIED RAT; ROOF RAT.—One specimen, ♂ ad., Feb. 20, 1893.

"The specimen sent was caught on a boat which made trips between St. Charles Peninsula and Rockport. Lucas Dubois, the captain, said it had been on the boat about a year before he caught it. I have heard of rats being killed on other boats here, but they may have been of other species."—H. P. A.

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[1] There are half-grown young in the collection taken August 14 (at Brownsville), and as late as Oct. 20 and Nov. 15 (the last two at Rockport).

9. **Mus musculus** *Linn.* HOUSE MOUSE.— Eleven specimens, part caught in the house and part in the fields. They vary much in color, particularly on the ventral surface, as house mice are apt to do at other localities. Two are dingy reddish gray below ; one is nearly pure white ; others are grayish white tinged with buff, and one is strong reddish buff. Age and season doubtless have much to do with this variation, but it is doubtless largely purely individual.

11. **Neotoma micropus** *Baird.* TEXAS WOOD RAT.— Eleven specimens of this species include specimens taken in January, March, June, September, October and December. Three belonging to one litter and less than one-fourth grown, were taken March 30. These are clear ashy gray above washed with black, the prevailing color of the middle of the dorsal area being deep black.

There is little to add to the account of this species already given.[1] The Museum has now large series from Brownsville, Corpus Christi, and Rockport. Several of the Rockport (June and September) specimens have the pelage of the posterior parts of the body very much abraded.

"Common on the main land wherever bunches of Opuntia are growing, but I have not found them on any of the islands. They may, however, occur on St. Joseph Island. I caught one under a wharf, near the water's edge, in the main part of the town of Rockport, in a trap baited with sweet potato. Capt. N. C. Phillips, an old settler, says these rats are excellent eating, in his estimation far superior to squirrel meat.

"I found a nest once in a club house on Copano Bay, used in the hunting season by duck hunters. A pile of all kinds of material had been carried in, and a nice round nest, open on the top, made in the middle of it."—H. P. A.

12. **Sigmodon hispidus texianus** (*Aud. & Bachm.*). TEXAS COTTON RAT.—This species is represented by a series of 42 specimens, taken between Sept. 30 and March 30, the other

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[1] This Bulletin, Vol. III, pp 282–285, June, 1891.

months of the year being unrepresented. They fall into two quite sharply differentiated phases—a blackish-gray phase, slightly varied with pale yellowish brown, and a yellowish-brown series, slightly varied with blackish. If they came from widely separated localities they might easily be taken for well-marked geographical forms. Mr. Chapman's Corpus Christi series of 10 specimens is separable in the same way, as he has already noted (this Bulletin, V, p. 45). In this case Mr. Chapman states that the dark specimens came from the marshes, where their runways "led beneath the dense mat of marsh grass," and the light specimens from the dry, scrubby chaparral, where they were more exposed to the bleaching effect of the sunlight. In view of Mr. Chapman's experience I wrote to Mr. Attwater for definite information as to the kind of ground in which the specimens were taken. In reply he states that *all* the specimens came from the islands, where the highest ground—an old railway bed—is "only five feet above the water-line of the bays, and the highest natural level only three feet, the average being about two feet. At high tides much of the land is flooded. The entire location was cut up with channels and bayous, and on the whole would be properly described as a *damp* situation. The rats made their homes on the higher spots in half-flooded situations, generally along the sides of the railway 'dump,' but no part of their haunts could be compared with the 'dry scrubby chaparral.'" In this case therefore it would seem that the two phases above mentioned simply represent individual variation assorted in accordance with the tints of the pelage into two series! Yet there are comparatively few well-marked 'intergrades.'

Ten adults, as measured by the collector, give the following: Total length, 258 to 308 mm., averaging 282; head and body, 137 to 174, averaging 156; tail vertebræ, 110 to 133, averaging 126[1]; hind foot, 31 to 33, averaging 32.

Six adults from Corpus Christi, measured in the flesh by Mr. Chapman, give the following: Total length, 264 to 290, averaging 277; head and body, 145 to 180, averaging 170; tail vertebræ, 97 to 121, averaging 109[1]; hind foot, 30 to 33, averaging 31.5.

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[1] The discrepancy in the relative length of the tail in these two sets of measurements is doubtless due to different methods of measuring, as regards the starting point for taking the length of the tail.

As regards seasonal variation, November and December specimens average darker than those taken in other months, while the March specimens are much the lightest of the series. As previously stated, the months of April to August, inclusive, are unrepresented.

" *Sigmodons* are common on the group of small islands (marked No. 2, No. 3 and No. 4 on the map I send you), particularly so on Island No. 2, and at the 'Point' or 'Pocket' where *Oryzomys* was found. I have found none on the mainland. They may occur on St. Joseph Island, as they are good swimmers. Their favorite haunts are the thick growths of cacti (*Opuntia*), and the thick matted grass that grows near the water's edge. They have been found living with *Oryzomys* and *Onychomys* in the bunches of cactus. Their nests are usually placed on the ground among cactus roots, or under piles of brush, and among the roots of the dwarfed huisache bushes, and are usually composed of anything handy. One nest was made entirely of hog bristles, taken from a dead hog lying near a bunch of cactus. When disturbed they retreat into shallow holes in the ground. They are much preyed upon by rapacious birds and mammals—by the marsh hawk in the day time and by the short-eared owl at night. A great many are also captured by rattlesnakes, and probably also by raccoons and skunks."—H. P. A.

13. **Oryzomys palustris texensis,** subsp. nov.

Above very pale yellowish gray-brown, varied with blackish over the middle of the dorsal region, forming an indistinct blackish dorsal band ; sides yellowish gray, very slightly varied with blackish tipped hairs. Below clear grayish white, the fur plumbeous at base.

Total length (of type, No. $\frac{7166}{5764}$, ♂ ad., Rockport, Texas, Nov. 15, 1893, H. P. Attwater), 277 mm. ; head and body, 137 ; tail vertebræ, 140 ; hind foot, 30.5.

Seven adult males give the following, based on the collector's measurements taken from the fresh specimens : Total length, 249 to 280, averaging 264 ; head and body, 122 to 146, averaging 131 ; tail vertebræ, 122 to 140, averaging 132 ; hind foot, 28.5 to 30.5, averaging 30.

This is simply a large pallid form of the *O. palustris* group. The Rockport series, when compared with Louisiana and Florida specimens of *O. palustris natator* Chapm.,[1] is strikingly different in coloration, about as different, and differing much in the same way, as the Brown Rat (*Mus decumanus*) and the Muskrat. The color differences are much less when the Rockport series is compared with North Carolina specimens (true *O. palustris*), but are still very appreciable, while the size is much larger. The following comparative measurements indicate the average size of the three forms (measurements in millimetres) :

	No. of Specimens.	Locality.	Total length.	Tail.	Hind foot.
O. palustris.[2]	5 ♂	Raleigh, N. C.....	237	120	30
O. p. natator[2]	5 ♂	Gainesville, Fla....	286	136	33
O. p. texensis.....	7 ♂	Rockport, Texas...	264	132	30

This is doubtless the large pale form mentioned by Dr. Coues (Mon. N. Am. Roden., 1877, p. 116) as occurring at Neosho Falls, Kansas. All of the *Oryzomys* thus far examined from Brownsville, Texas, have proved to be *O. aquaticus*—a very different species from any form of the *O. palustris* group. On the other hand, Corpus Christi (Chapman, l. c., p. 45) and Rockport specimens have all proved referable to what is here named *O. p. texensis.*

The Rockport series numbers 29 specimens, and includes young of various ages, middle-aged specimens, and eight or ten that are fully adult. Two were taken in March, one in January, and the rest between Oct. 4 and Dec. 5. One (No. 65, Coll. H. P. Attwater) is exceptionally rufescent ; this is the single example mentioned by Mr. Chapman (l. c., p. 45) as apparently referable to his *O. p. natator.*

"The specimens were all taken at one locality, and nearly all from the 'Point' or 'Pocket' near the mainland [see Map, p. 166]. Some of them were found in holes in the shell ridge formed by the abandoned railway bed, where the *Sitomys mearnsii* were taken. In fact, they made nests in the holes I had formed on former visits in digging out *S. mearnsii.* They were much more common in 1893 than in 1892. I think they move about somewhat, as I have found them in places where I had vainly searched for them a short time before. Their favorite resorts are places where the Spanish bayonet (*Yucca*, sp.) grows. They make many nests among the leaves of this plant, placing them close to the stem, beneath the dead leaves, which hang down and afford them shelter. They also nest in holes in the shell ridges. In most cases I have found the male and female in the same nest, but in the yuccas and among the prickly pears, the males and females appeared to occupy separate nests. They also live in the piles of sea weed which accumulate along the beach. Favorite places for them are the 'duck-blinds' made by the hunters for concealment in duck shooting. I once heaped together a small pile of yucca and weed stalks, and used to find one or two of these mice under it whenever I visited the place, during October and November. They eat all kinds of weed seeds, and are very fond of the seeds of the prickly pear."—H. P. A.

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[1] *Cf.* Bull. Am. Mus. Nat. Hist., V, p. 44, March 17, 1893

[2] *Cf.* Chapman, l. c., p. 44.

14. **Sitomys mearnsii** (*Allen*). MEARNS'S WHITE-FOOTED MOUSE.

Vesperimus mearnsii ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 300, June, 1891 (Brownsville, Texas).
Sitomys mearnsii BRYANT, Zoe, III, Oct. 1892, p. 214.

Represented by a series of 26 specimens, including adults and young of various ages, and also by several nests, collected mainly between Oct. 2 and Jan. 2. As a series they differ very appreciably from a similar series from Brownsville, collected chiefly in August and September. The two phases are evidently too close, however, to require separation. There is practically no difference in size or proportions, judging by the measurements taken by the collectors from the fresh specimens, the slight discrepancy in the relative length of the tail being doubtless due to different methods of measuring. Thus, 14 adult specimens from Brownsville give the following averages and extremes: Total length, 175 to 182 mm., averaging 177; head and body, 89 to 105, averaging 97; tail, 74 to 85, averaging 80; hind foot, 19 to 22, averaging 20. A series of 12 adults from Rockport gives the following: Total length, 160 to 190, averaging 172; head and body, 76 to 101, averaging 84; hind foot, 19 to 21.5, averaging 20.

In coloration many of the specimens are indistinguishable, but as a series the Rockport specimens are slightly more rufescent, several of the specimens shading much more strongly toward chestnut than any in the Brownsville series. Several Bee County specimens,[1] it is of interest to note, are all as strongly chestnut as the brightest Rockport specimens. One-third of the Brownsville specimens show some trace of a rufescent pectoral spot, while in one-fourth of them it is quite strongly defined, but in the Rockport series not one shows the slightest tendency to such a spot.

"Most of these mice were taken from nests placed in holes in the slopes of an abandoned railway embankment. They are found, however, elsewhere, and even enter houses, where they live with common house-mice, specimens of both having been taken at the same time in the same room.

"The various nests obtained were placed in the sloping railway embankment, at the end of a horizontal burrow, from six inches to two feet in length. Often there is also a vertical exit to the top of the level ground, so that after digging in to the nest one finds that the mouse has escaped up through the other hole. No attempt is made to conceal the entrance. The nests are generally made of anything handy, generally of sea moss, and occasionally of fine grass, or tow, the latter obtained by gnawing up old pieces of rope or twine found on the beach. The breeding season is so arranged that the young are born about the time the seeds of various weeds, on which they feed, begin to ripen. Before the young are born a male and female will be found occupying the same nest, but after this event the male will be found in another hole not far away. Four to six is the usual number of young in a litter. I have several times taken the old female and her young ones home with me to try and raise them, but in a day or two the young ones began to die. On one occasion (Oct. 2) I caught a male and female in separate holes and put them together in a box alive. During the night young were born, of which three were found in the box the next morning, and the remains of one or two more, in the stomach of the male. At another time a male and female, the latter having newly-born young, were put in a box, and in the morning it was found that the male had killed and eaten two of the five young ones.

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[1] These were formerly incorrectly referred to "*Vesperimus leucopus texanus*" (= *Sitomys americanus texanus*). *Cf.* Bull. Am. Mus. Nat. Hist., III, p. 224, April, 1891. The *texanus* phase is quite different.

"I have never seen any fawn-colored spot on the breast of any *Sitomys* found in this locality."—H. P. A.

15. **Sitomys (Baiomys) taylori** (*Thomas*). TAYLOR'S MOUSE.—One specimen, ♂, Oct. 19. Apparently a rare species near Rockport.

"Brought to me by a boy, who said he found it while digging Wood Rats out of a bunch of prickly pear."—H. P. A.

16. **Onychomys longipes** *Merriam.*[1] TEXAS GRASSHOPPER MOUSE.—Six specimens, March and December, including adults and young. Identified as this species by Dr. Merriam.

"This species I found least common of any of the small mammals. They are much slower in their movements than *Sigmodon*, *Oryzomys*, and others, and probably for this reason get picked up by hawks, owls, skunks, etc. Two young specimens were caught in traps set over *Perognathus* holes. They probably wander around, looking into holes and crevices for beetles and other insects, and may find many 'square meals' in the *Perognathus* entrances. All were found at the 'Point' close to the mainland, which is surrounded most of the time by mud and water. Two, male and female (probably a pair), were dug out of a shallow hole in the ground among the roots of some dwarfed huisache bushes, and another among the roots of *Opuntia*. At one of these places I found several hundred wings of butterflies [*Danais archippus*], the bodies of which had been eaten by the *Onychomys*.[2] Wings of these butterflies were often found scattered all over this particular locality. These butterflies [identified as above from specimens sent by Mr. Attwater] appear to be migratory, coming here by thousands in the fall."—H. P. A.

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[1] N. Am. Fauna, No. 2, Oct., 1889, p. 1. Concho Co., Texas.

[2] This observation is of special interest from the fact that this butterfly is supposed to be 'protected' by a nauseous odor or taste that renders it unpalatable to animals.

17. Spermophilus mexicanus (*Licht.*). MEXICAN SPERMOPHILE.— Four specimens, Oct. 3, 1893.

"These specimens were sent to me from some place near Gregory, between Corpus Christi and Rockport. They are not nearly as numerous in Aransas County as they are about Corpus Christi. I hear of a few in the Black Jack Peninsula, and occasionally near Rockport, but they are quite scarce."—H. P. A.

Mr. Frank M. Chapman collected a series of nine specimens at Corpus Christi, April 8–11, 1891, where he found them locally abundant along the coast, but apparently absent in the interior. Aransas County seems to form their northern limit of distribution in the coast region of Texas.

The type of *Spermophilus mexicanus* came from Toluco, near the City of Mexico. In the absence of material from the type locality the Texas specimens are provisionally identified as above.

Five adult males in Mr. Chapman's series give the following average measurements, taken by the collector before skinning: Total length, 304 mm.; head and body, 188; tail, 116; hind foot, 40. The Corpus Christi specimens do not differ appreciably from a large series from Brownsville.

18. Spermophilus spilosoma annectens *Merriam.*[1] PADRE ISLAND SPERMOPHILE.—One specimen, Mustang Island, near Aransas Pass, 12 miles from Rockport, Oct. 26, 1893; 4 specimens, same locality, April 25, 1894. These latter have been submitted to Dr. Merriam for examination, who finds them to agree with his Padre Island series.

"Spermophiles are said to be very common on Mustang Island. I sent over for specimens, and No. 129 [as recorded above] was sent to me. It was killed near the life-saving station [at the north end of the island]. I am told they are found all over Mustang Island, but there are none on St. Joseph Island, nor can I hear of any ever having been found there."—H. P. A.

Mustang Island is practically a continuation of Padre Island, the type locality of this subspecies, although at present separated from it by a narrow inlet only a few miles in width. St. Joseph Island, only slightly separated from Mustang Island, is a further continuation of the remarkable series of 'sand-spits,' or low, narrow, sandy islands, that extends from near the mouth of the Rio Grande north to Matagorda Bay, and is continued still further in the narrow Matagorda Peninsula. Apparently Mustang Island forms the northern limit of distribution of this peculiar form of Spermophile.

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[1] Proc. Biol. Soc. Washington, VIII, p. 132, Dec. 28, 1893.

19. Sciurus niger limitis (*Baird*). TEXAN FOX SQUIRREL.— One specimen, ♂ ad., Rockport, Feb. 27, 1893. Not appreciably different from a specimen from the type locality (San Pedro or Devil's River) of Baird's *Sciurus limitis*, recently received from Dr. E. A. Mearns.

"There are no Fox Squirrels in Aransas County except on St. Charles Peninsula, where there are several square miles of blackjack oaks. This area is separated from the timber on the Guadaloupe River by prairie land, so that this colony of Fox Squirrels is practically isolated."—H. P. A.

20. Dicotyles angulatus *Cope.*[1] PECCARY.—"Formerly common in Aransas and adjoining counties, but now rarely met with. On Aug. 20, 1892, a large male was killed in front of the Bay View Hotel on the beach in the city of Rockport. It was in the shallow salt water, rooting among the sea grass. It was a season of great drouth, and I fancy the dry weather may have had something to do with its wanderings."—H. P. A.

21. Bison americanus (*Gmel.*). AMERICAN BISON.—"I have been told by old residents that the horns and bones of this animal were formerly found on the prairies of Aransas County."— H. P. A.

22. Cariacus virginianus (*Bodd.*). VIRGINIA DEER.— There are no specimens in the collection, and the following note is therefore provisionally assigned to this species.

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[1] Am. Nat., XXXIII, p. 147, Feb., 1889.

"Rare on the peninsulas, but quite numerous on St. Joseph Island, where they are protected by Messrs. Wood and Allyn, who own the island and use it as a cattle and sheep ranch. Captain Bailey informs me that about 1857 or 1858 thousands of deer died throughout this region from a disease called the 'black tongue,' on account of the tongues in the dead animals being found to be black."—H. P. A.

Note on the Camels introduced into Texas.—As is well known, the United States Government introduced, many years since, two shipments of Camels[1] into Texas, with a view to their acclimatization and use for military purposes. Mr. Attwater made casual reference to the matter in his notes, and on applying to him later for more definite information, he has obtained and kindly transmitted an important letter, written at his solicitation, by Capt. C. F. Bailey, an old settler and prominent citizen of Rockport, from which the following interesting extracts are taken. According to 'Reports upon the Purchase, Importation and Use of Camels and Dromedaries, to be employed for Military Purposes, according to Act of Congress of March 3, 1855,' made by Major Henry C. Wayne (published as Senate Ex. Doc. No. 62, 34th Congress, 3d Session, 1857), it appears that the first shipment, consisting of 34 animals, was landed at Indianola, Texas, May 13, 1856, and the second, of 41 animals, at the same port, Feb. 10, 1857. Says Capt. Bailey: ". . . . I personally saw about half-a-dozen of these camels myself during the year 1863 . . . After landing the camels were loaded only once for the upper country [San Antonio], and then returned to the coast, when the war broke out, and the Confederate authorities not wishing to be bothered with them turned them loose, particularly as the Arabs who had been brought out to manage them had also left. They wandered and scattered without control, let or hindrance all over the country from the Nueces to Indianola, and from San Antonio to the Gulf, with never more than two or three in a bunch. I never heard of but one being killed, and that was on the Aransas River. He was a particularly ugly old male, would pursue and attack every one he saw, whether mounted or on foot, and was killed by a party on horseback he was pursuing. The last I ever heard of any of them was that a stockman gathered all he could find, either seven or eight, and sold them to the manager of a circus that was traveling through the country, as every body sold every body's else cattle in those days, to be paid for if claim was ever made. It is safe to say that no claim was ever made. This sale was in 1867, I think. Whatever became of the majority of them no one can ever positively tell. I never heard of but one young one being born in this country. An old female with a young one following her was seen near Indianola in 1860 or 1861. I do not think it ever grew to maturity."

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[1] There appear to have been several Dromedaries in the first shipment.

23. **Atalapha noveboracensis** (*Erxl.*). RED BAT.—Five specimens, Rockport, August and September, 1893.

As I have elsewhere stated,[1] there is a well-marked sexual difference in color in the present species, the females being darker and duller than the males, with the whitish tipping of the hairs broader, giving a very different general effect to the coloration.

"The only bats I found were the red ones I sent you. I think they stay around trees and roost in them. Captain Phillips informs me that he has noticed also a small brown bat."—H. P. A.

It may be worth while to record in this connection the capture of *Atalapha cinerea* (Beauv.) from Texas, there being in the collection of the American Museum a specimen from Brownsville (Oct. 24, 1891, F. B. Armstrong), and another from probably Bee County (exact locality uncertain), presented by Mr. George B. Sennett.

There is also in the Museum a series of six specimens of *Dasypterus intermedius* (H. Allen) from Brownsville, Texas (March 17–19, May 28–30, Aug. 29, F. B. Armstrong), where it is apparently not uncommon.

24. **Scalops texanus** *Allen.* TEXAS MOLE.

Scalops argentatus texanus ALLEN, Bull. Am. Mus. Nat. Hist. III, p. 221, April, 1891.

Scalops texanus ALLEN, *ibid*, V, p. 200, Aug. 1893.

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[1] Bull. Mus. Comp. Zoöl., I, No. 8, Oct., 1869, p. 207.

This species is represented by a series of 26 specimens, collected by Mr. Attwater in the vicinity of Rockport. They vary considerably in coloration, independently of age, sex, or season, mainly in the amount of orange suffusion pervading the pelage. A few specimens show it in comparatively slight degree; in others it is very strong, so that when held from the light the anterior half of the ventral surface is often deep chestnut orange. The head, and sometimes the anterior third of the dorsal surface, is usually much more fulvous than the rest of the upper surface. There is generally a well-defined orange spot on each side of the nose, the two spots sometimes uniting across the base of the forehead.

The collector's measurements of 12 adult males give the following extremes and averages: Total length, 135 to 147 mm., averaging 141; tail, 23 to 27, averaging 25; hind foot, 16.5 to 19, averaging 17.8. Eight females average slightly smaller, as follows: Total length, 132 to 146, averaging 137; tail, 20 to 25.5, averaging 23; hind foot, 15 to 18, averaging 16.5.

"Moles are very numerous all over the peninsula, perhaps the most common of any of the small mammals. They are extremely hard to catch, frequently going around and under the trap. They work chiefly at night, and go sometimes two or three hundred yards to find a good feeding place. They are particularly active after a rain, the rain probably having something to do with the movements of the insects on which they feed.

"Mole runways are very common even in parts of the country where the soil is very poor, apparently nothing but sand, and the vegetation consists of shrubby oaks and sweet bays, and where no other small mammals are found. But they are most numerous where the soil is more or less damp, as in the so-called 'sub-irrigated' lands, where the dampness comes nearly to the surface. During very dry weather the moles descend deeper into the ground, as owing to the dryness of the soil the runways then fill by the crumbling sand when near the surface. They appear also to be more active in the fall, spring and winter months than in summer, when, from the greater abundance of insects, they may be able to procure food with less effort.

"The position selected for the nest is several feet below the surface, and always in a hard place to get at, being generally under a clump of bushes or a tree. A nest I dug out was made of fine grass. I have never seen any young ones, nor caught any that were very small."—H. P. A.

25. **Procyon lotor hernandezii** (*Wagler*).—One specimen, from Corpus Christi (April 10, 1891, F. M. Chapman). There are no specimens in Mr. Attwater's collection, but he reports it as abundant, writing as follows :

" Raccoons are common on the peninsulas, and very abundant on St. Joseph Island. George Roberts killed 125 on this island during the winter of 1892-93, and W. A. Brundrett sold 175 'coon' skins taken on Matagorda Island, the next island to the east of St. Joseph, and in the next county. They live in the long grass in the marshes on the side nearest the bays, and in the chaparral on the ridges. Their food consists chiefly of crabs, shell-fish, dead fish washed on the shores, wounded ducks and other birds, birds' eggs, berries, etc. I have not had an opportunity to put up a series of specimens, but have seen a number of skins, which appear to me to be lighter in color, and as a rule much more yellowish than those which are found further inland." —H. P. A.

26. **Bassariscus astutus** *Licht.* CIVET CAT.—Not represented in the collection.

" One was killed in Aransas County last year, and I have heard of several others being taken on St. Charles Peninsula. They are very common in the counties to the north and west, and do considerable damage by destroying chickens while roosting in the trees around the ranches.

" Captain Robert Strachan, who has charge of the main wharf at Rockport, has a pet Civet Cat which has been loose in the warehouse for about two years. It often comes and eats out of his hand. It drinks milk, and will eat cheese, meat and fish (cooked and raw). He says there were a few rats in the warehouse when he first got the Civet Cat, but it soon cleared them out. It disappeared once for several months, but returned again. It was caught in Bee County."—H. P. A.

27. Conepatus mapurito (*Gm.*).—This species is represented by two skulls. Mr. Attwater refers to a mounted specimen in his collection, and speaks of the species as less common even than the Little Striped Skunk. The specimens sent were taken in the outskirts of the town of Rockport.

28. Mephitis mesomelas *Licht.* TEXAS SKUNK.

Mephitis mesomelas LICHT. Darst. neuer oder wenig bekannter Säug. 1827-34, Taf. XLV, fig. 2, and accompanying text ("Louisiana"); BAIRD, Mam. N. Am. 1857, p. 199 (based on above).

Mephitis varians GRAY, Charlesworth's Mag. Nat. Hist. I, 1837, p. 581 (Texas; from Mr. Drummond's Coll.); List Mam. Brit. Mus. 1843, 69 (same; in part only, of Gray's later papers); BAIRD, Mam. N. Am. 1857, p. 193 (Texas); Zoöl. Mex. Bound. Surv. Mamm. 1859, p. 19 (Texas and N. E. Mexico).

Mephitis macroura AUD. & BACH. Quad. N. Am. III, 1853, p. 11, pl. cii (San Antonio, Texas; not *M. macroura* Licht.).

Two specimens, ♂ and ♀, Rockport, March 23 and Oct. 20, 1893. They agree very closely with a series of 12 adult specimens from the late 'Neutral Strip,' now part of Oklahoma, collected by Messrs. Richardson and Rowley on the Museum Expedition of 1889.

These 14 specimens are very uniform in coloration and size, there being no noteworthy variation in the whole series. Moreover, in style of coloration, in size and relative proportions, they agree closely with the figure and measurements given by Lichtenstein (l. c.) for his *Mephitis mesomelas*. Lichtenstein refers to a single example in the Berlin Museum, on which the species was based, as having been received from a dealer, with the statement that it came from "Louisiana." How long it had been in the Museum when he wrote, and whether it came from the present State of Louisiana, or from the Louisiana of early days, are matters now impossible to determine. The probability that the Skunk of eastern and northern Texas ranges eastward into western Louisiana, as well as northward to Oklahoma, and that the original specimen of Lichtenstein's *M. mesomelas* is quite likely to have come from some part of this area, coupled with the fact that almost any one of the dozen Oklahoma specimens before me might have served as the basis of his description and figure, seems to render desirable the adoption of Lichtenstein's name for the species here under consideration.

The characters of this species may be indicated as follows :

Size large ; tail long, full, broad and bushy, rather squarely truncated at the end, the vertebræ alone about half the length of the head and body. Total length, 725 mm. ; head and body, 408 ; tail vertebræ, 252 ; tail to end of hairs, 317 (average of 8 adults from the ' Neutral Strip ' ; measurements from skins). General color black, with the usual white frontal stripe very narrow and not reaching the white patch on the nape ; nuchal patch broad, square in front, narrowing posteriorly to the interscapular region, where it is usually much narrower than at the front border ; slightly behind the shoulders it divides into two broad lateral bands which pass, one on each side of the body, on to the basal portion of the tail ; between these is a median dorsal band of usually about the width of one of the lateral white stripes, and is continued over the basal half or two-thirds of the tail. The tail hairs are all white basally and black apically, except a few that are wholly white. The latter vary in number in different specimens, being few in some but generally numerous enough to form conspicuous tufts along the sides of the tail, and generally also on the dorsal surface, where at the base of the apical third they often form a more or less pronounced whitish spot, or even a well-marked white band. About half the specimens show a pair of small, oval, symmetrically arranged spots of white on the breast. There is no pencil of white in the tip of the tail, which is wholly black, thick, and obtusely truncate at the end.

Lichtenstein's description, as already said, is strictly pertinent to the present animal. His measurements, translated into millimeters, are as follows : Total length, 731 mm. ; head and body, 432 ; tail vertebræ, 229 ; tail to end of hairs, 299. Compared with my average for 8 Oklahoma specimens, the difference is practically nothing—not greater than occurs between different individuals of the Oklahoma series.

One of the two specimens in Mr. Attwater's collection is practically identical with several of the Oklahoma specimens ; the other is similar except that the amount of white is much reduced, the frontal stripe being narrowed to a line of scattered white hairs ; the nuchal patch is also narrower and much shorter, dividing in front of the shoulders into two very narrow lateral stripes, which disappear entirely in front of the hips. Also only a very few scattered white hairs reach the surface of the tail. Mr. Attwater states in his notes that in Aransas County this Skunk " varies much in color, some being very white, and I have been told that pure black ones have been killed." He further states that it is the common Skunk of Aransas County, being far more numerous than either of the other two species.

This species differs from the eastern *M. mephitica* in being rather larger, apparently in greater constancy of coloration, and in the posterior extension (ordinarily) of the lateral white stripes on to the basal third of the tail. It also varies in cranial characters, the skull being relatively narrower and longer, with the zygomatic arches less expanded, but especially in the much heavier dentition. Thus the length of the lateral tooth line to the basilar length of the skull is as 37 to 100, while in *M. mephitis* it is as 34.5 to 100. The ratio of breadth across the last molars to basilar length is as 46 to 100, as against 43 to 100 in *M. mephitica.*

Compared with *M. estor* Merriam, from Arizona, *M. mesomelas* is much the larger, the skull averaging 6 mm. longer in basilar length, and 5 mm. wider in zygomatic breadth. Both belong to the western section of the genus, characterized by heavy dental armature, as compared with the Skunks from east of the Great Plains. Several Minnesota specimens agree very well in size and coloration with *M. mesomelas*, but agree with eastern specimens in their weaker dental armature and correlated cranial modifications.

Having spent considerable time in measuring a large series of skulls of the genus *Mephitis*, in the present connection, I append the accompanying tables of results, including averages and ratios of about 34 specimens, believing it may have some interest to other students of this troublesome group.

In explanation of the tables it may be added that the proportion of very old skulls is very small, and all obviously undergrown specimens were excluded ; "juv" in the table simply means 'young adult.' Where the sex sign is followed by an interrogation mark, the specimen was received without the sex being indicated by the collector, but in each case the sex as given in the table is almost beyond question correct. The three Minnesota specimens are all very old, which may in part account for their very large size, as compared with any others in the series, although they probably indicate a large form of the *M. mephitica* group.

The second table is an abridged summary of the first, on which it is based, giving most of the elements of real value, and omitting many that are practically worthless. As in the case of Dr.

I.—CRANIAL MEASUREMENTS

MEASUREMENTS AND RATIOS.	*Mephitis mesomel*							
	Neutral Strip, Oklahoma.							
	No. 3025	No. 3027	No. 4601	No. 4602	No. 3740	No. 4334	No. 3026	No. 3029
MEASUREMENTS.	♂ ad.	♂ juv.	♂ ? ad.	♀ ? ad.	♀ ad.	♀ ad.	♀ ad.	♀ juv.
Occip. condyle to ant. bord. premax	74.0	71.5	71.2	66.0	64.0	67.0	67.5	66.0
Occip. crest to ant. bord. nasals	70.0	66.0	68.0	63.0	62.0	64.5	65.0	63.0
Basilar length (Hensel)	66.0	63.2	63.5	59.0	58.0	59.5	59.5	58.0
Greatest zygomatic breadth	46.0	45.0	43.3	42.0	43.5	41.8	44.0	42.0
Greatest mastoid breadth	38.5	38.0	38.2	36.0	34.5	36.0	38.0	35.0
Least postorbital breadth	19.0	20.0	20.6	18.5	19.0	20.0	19.0	18.0
Foram. mag. to post. bord. palatals	38.5	37.2	36.0	34.0	34.5	33.2	35.0	33.0
Length of palatal floor	27.5	27.0	28.0	28.0	25.0	27.0	25.0	26.0
Length of pteryg. fossa (base of ham proc. to post. bord. palat.)	16.5	16.2	16.0	15.0	13.5	15.3	16.0	13.0
Height of cranium at basisphenoid	23.5	22.0	23.0	23.0	22.0	23.0	23.0	23.0
Height of cranium at postorb. proc	22.0	23.7	23.7	24.0	22.0	22.0	22.0	20.0
Length of tooth-row (at alveoli)	24.0	23.5	23.8	24.0	21.3	22.2	22.3	22.5
Length of incisor tooth-row	11.0	11.7	10.6	10.0	10.0	10.0	11.0	10.0
Distance between ext. bord. last molars	30.0	29.0	27.0	27.0	27.0	27.0	27.0	26.5
Distance between ext. bord. canines	19.5	18.0	18.2	18.0	17.0	17.0	18.0	17.0
Length of mandibular ramus	50.0	48.5	48.5	44.0	45.0	46.5	46.0	44.0
Height of mand. ramus (angle to cor. proc.)	26.0	24.6	24.0	21.0	22.3	21.0	22.0	21.0
RATIOS *to Basilar length* (*Hensel*).								
Zygomatic breadth	69.7	71.0	68.2	71.2	75.0	70.3	74.0	72.4
Mastoid breadth	58.5	60.1	60.2	61.0	57.8	62.0	64.0	60.4
Length of palatal floor	41.7	42.7	44.1	47.5	43.1	45.4	42.0	44.8
Distance from foram. mag. to post-palatal border	58.5	59.0	56.7	57.6	59.5	55.8	59.0	56.9
Length of lateral tooth-row	36.2	37.2	39.1	40.7	36.7	37.3	37.5	38.8
Breadth across molars	45.5	45.9	42.5	45.8	46.5	45.4	45.4	45.7

AND RATIOS OF THIRTY-FOUR NORTH AMERICAN SPECIMENS OF

s.			*Mephitis mephitica.*																
			Fort Snelling, Minn.				Ohio.	Indiana.			New York.						Fort W		
No. 3428	Averages.		No. 2891	No. 3727	No. 3724	Aver. Very old.	No. 1177	No. 4384	No. 4385	No. 4386	No. 2018	No. 2019	No. 2020	No. 314	Averages.		No. 1914	No. 1910	No
♀ ad.	3 ♂ ♂	6 ♀ ♀	♂ ad.	♂ ad.	♂ ad.	3 ♂ ♂	♂ ad.	♂? ad.	♂ ad.	♀? ad.	♂? ad.	♀? ad.	♂? ad.	♂ ad.	4 ♂	4 ♀	♂ juv.	♂ ad.	♂ ad
69.3	72.2	66.6	74.5	80.0	79.0	77.8	74.0	68.0	67.0	68.0	71.0	66.0	70.0	68.5	70.9	67.2	67.0	65.2	70.
64.0	68.0	63.6	70.0	74.0	74.0	72.7	69.0	63.2	62.5	63.0	67.0	61.0	67.0	66.0	67.2	62.4	63.0	63.0	68.
60.7	62.1	59.1	66.0	71.0	71.0	69.3	68.0	61.0	57.5	59.0	62.0	59.5	62.0	62.0	63.5	59.2	59.5	59.0	61.
43.5	44.6	42.8	47.0	53.0	....	50.0	49.0	44.0	42.0	44.0	45.0	43.0	47.0	45.5	46.6	43.2	41.5	41.0	44.
36.0	38.2	35.9	41.0	47.5	44.5	44.3	44.0	36.0	35.5	39.0	38.0	36.5	41.0	40.0	40.8	36.7	35.0	37.0	38.
19.0	19.9	18.9	21.0	....	18.0	19.5	20.5	20.0	18.0	19.0	19.0	19.0	18.2	18.0	19.0	19.0	19.0	19.0	20.
35.0	37.2	34.1	38.5	41.0	41.0	40.1	38.0	34.0	33.0	35.0	35.5	34.5	35.5	34.5	35.9	34.1	33.5	34.0	36.
26.5	27.5	26.3	27.2	30.0	30.0	29.1	29.5	26.5	25.5	26.0	27.0	25.0	27.0	27.0	27.6	25.6	25.0	25.0	26.
16.0	16.2	14.8	17.0	19.0	17.0	17.7	17.0	15.0	14.0	15.0	15.0	15.5	15.5	17.0	16.1	14.9	15.0	19.0	15.
21.5	22.8	22.6	25.0	25.0	25.0	25.2	24.0	24.0	22.0	21.0	23.0	24.0	23.3	22.0	23.1	22.8	22.0	23.0	21.
21.5	23.8	21.9	24.0	26.0	25.2	25.1	24.0	23.0	21.7	22.0	22.5	22.0	22.0	22.0	22.0	22.2	21.5	22.0	21.
23.0	22.6	22.6	22.1	24.6	24.0	23.6	24.0	22.0	22.0	20.5	22.0	21.0	21.0	21.0	22.0	21.9	21.0	22.0	22.
11.2	11.1	10.2	11.1	12.5	11.0	11.5	10.0	10.2	9.8	9.0	9.5	9.5	9.5	9.5	9.6	9.6	9.8	11.0	10.
27.0	28.7	26.9	28.3	31.0	29.0	29.4	28.7	26.5	27.0	26.0	26.5	26.0	27.0	26.5	27.2	26.4	26.0	26.0	27.
16.5	18.6	17.3	18.7	21.0	19.0	19.6	19.0	17.0	17.0	16.5	16.5	16.0	18.0	17.0	17.6	16.6	16.8	18.0	18.
46.5	45.7	45.6	49.5	55.0	54.3	53.0	51.0	47.0	46.0	45.5	46.0	45.0	49.0	48.0	48.5	45.9	44.0	46.0	48.
22.0	24.9	21.6	23.0	28.0	27.0	26.0	26.0	23.0	20.5	20.5	22.5	21.5	24.0	21.0	25.9	21.4	22.8	24.0	23.
71.7	71.8	72.4	71.2	74.6	....	72.2	72.1	72.1	73.0	74.6	72.6	72.3	75.8	73.4	73.5	72.9	69.7	69.5	72.
59.3	61.5	60.4	62.1	67.0	62.7	63.9	64.7	59.0	61.7	60.1	61.3	62.9	66.1	64.5	64.3	61.8	58.8	62.7	61.
43.7	44.3	44.5	41.2	42.3	42.3	42.0	43.7	43.4	46.1	44.1	43.6	42.0	43.5	43.5	43.5	43.4	42.0	42.4	45.
57.7	60.0	57.7	58.3	56.3	56.3	57.9	55.9	55.7	59.1	59.3	57.2	58.4	57.3	55.7	56.5	57.6	56.3	57.6	58.
37.9	36.4	38.2	33.5	34.6	33.8	34.0	35.4	36.1	38.2	34.7	35.5	35.3	34.0	34.0	34.7	36.8	35.3	37.3	36.
44.5	46.2	45.5	42.9	42.3	40.8	42.4	42.2	43.4	46.4	44.1	42.0	44.0	43.6	42.7	42.8	44.6	43.7	44.1	43.

		Mephitis estor.											*Mephitis occidentalis.*	
, Arizona.				Pinal Co., Arizona.									Ducks, B. C.	
o. 13	No. 1909	Averages.		No. 595	No. 600	No. 603	No. 592	No. 591	No. 594	No. 596	Averages.		No. 1462	No. 1461
l.	♀ ad.	3 ♂ ♂	2 ♀ ♀	♂ ad.	♂ ad.	♂ ad.	♀ ad.	♂ ad.	♀ ad.	♀ ad.	3 ♂ ♂	4 ♀ ♀	♂? ad.	♀? ad.
.0	64.0	67.4	64.5	62.0	67.5	64.5	64.0	61.0	59.0	63.0	65.0	62.0	74.0	70.0
0	64.0	64.8	64.0	59.5	63.5	60.0	61.0	58.0	57.5	60.0	61.0	59.1	71.0	65.0
.0	57.0	59.6	57.5	55.5	59.0	58.0	56.5	54.0	52.3	57.5	57.8	55.1	66.0	61.0
7	40.5	42.2	41.6	41.0	41.7	41.5	41.5	39.0	39.5	40.0	41.4	40.0	46.0	45.0
0	36.0	36.7	35.0	36.0	35.0	35.0	35.0	34.0	34.5	35.0	35.3	34.6	40.0	40.3
.5	17.5	19.5	17.5	21.0	18.2	19.0	20.0	17.8	20.5	18.0	19.4	19.1	20.3	19.5
0	33.0	34.5	33.5	32.0	34.0	31.0	33.0	30.5	29.0	33.0	32.3	31.8	37.0	35.0
0	23.6	25.3	23.8	23.0	26.0	27.0	23.5	23.5	24.0	25.5	25.3	24.1	28.5	26.3
0	15.0	16.3	15.0	14.0	15.0	14.0	15.7	14.3	13.0	14.0	14.3	14.2	15.2	15.0
0	22.0	22.2	21.5	21.0	22.0	22.5	23.5	21.0	23.0	21.0	21.8	22.1	24.5	24.0
0	21.0	21.5	21.0	20.0	20.0	21.0	21.5	19.9	20.0	20.0	20.3	20.1	23.0	22.5
0	22.0	21.8	21.5	21.0	21.5	21.0	21.0	21.0	21.0	22.0	21.2	21.2	23.0	23.0
0	10.5	10.3	10.2	9.5	10.0	10.0	10.0	10.0	9.0	11.0	9.8	10.0	12.0	10.5
0	26.0	26.3	25.5	26.0	25.2	25.5	25.3	25.5	24.0	25.5	25.6	25.1	30.0	28.0
0	16.0	17.6	16.0	16.0	17.0	17.0	16.5	16.0	14.5	16.0	16.6	15.7	20.0	17.0
0	45.6	46.0	45.3	42.0	43.5	45.0	43.0	42.3	41.0	43.0	42.6	42.8	50.3	48.0
0	21.0	23.5	21.5	21.0	21.0	22.0	21.2	21.0	20.5	20.0	21.3	20.7	25.0	23.0
6	71.1	70.8	72.2	73.9	70.7	71.5	73.4	72.2	75.3	69.6	71.6	72.6	70.0	73.5
.6	63.2	61.6	60.9	64.6	60.8	60.3	61.7	62.9	65.7	60.9	61.1	62.7	60.0	66.1
.4	41.4	42.4	41.4	41.4	44.1	44.8	41.6	43.5	45.8	44.3	43.8	43.7	43.2	43.0
.6	57.9	57.7	58.2	57.6	57.6	58.6	59.3	56.5	55.3	57.4	56.0	57.7	56.0	57.4
2	38.6	36.9	37.4	37.8	36.4	37.1	37.2	38.8	38.3	39.1	36.7	38.5	34.9	37.7
.1	45.6	44.1	44.3	46.8	42.7	43.4	44.7	47.2	45.8	44.3	44.3	45.6	45.5	45.9

Merriam's much more detailed table of measurements of skulls of the genus *Spilogale* (N. Am. Fauna, No. 4, Oct., 1890), to quote from his remarks on the subject: "Many of the measurements, and more of the ratios, are worthless; and the table is published as much to show these as those which are really important" (l. c., p. 4). Although my tables give a much larger number of skulls per species than his, they are still too few to give satisfactory results, the addition of a single skull to a series of five or six being often found to modify some of the averages quite materially.

II.—SUMMARY OF MEASUREMENTS AND RATIOS.

MALES.

MEASUREMENTS.					
Number of specimens	3[1]	3[2]	4[3]	6[4]	1[5]
Basilar length	62.1	69.3	63.5	58.7	66.0
Zygomatic breadth	44.6	50.0	46.6	61.8	46.0
Mastoid breadth	36.2	44.3	40.8	36.0	40.0
Lateral tooth-row	22.6	23.6	22.0	21.5	23.0
Breadth across molars	28.7	27.2	27.2	25.9	30.0
RATIOS *to Basilar Length.*					
Zygomatic breadth	71.8	72.2	73.5	71.2	70.0
Mastoid breadth	61.5	63.9	64.3	61.3	60.0
Foramen mag. to palatine notch	60.0	57.9	56.5	56.9	56.0
Length of palatal floor	44.3	42.0	43.5	43.1	43.0
Lateral tooth-row	36.4	34.0	34.7	36.8	34.9
Breadth across molars	46.2	42.4	42.8	44.2	45.5

FEMALES.

MEASUREMENTS.				
Number of specimens	6[1]	4[3]	6[4]	1[5]
Basilar length	59.1	59.2	55.9	61.0
Zygomatic breadth	42.8	43.2	40.5	45.0
Mastoid breadth	35.9	36.7	34.7	40.3
Lateral tooth-row	22.6	21.9	21.3	23.0
Breadth across molars	26.9	26.4	25.2	28.0
RATIOS *to Basilar Length.*				
Zygomatic breadth	72.6	72.9	72.4	73.8
Mastoid breadth	62.6	61.9	61.0	66.1
Foramen mag. to palatine notch	57.7	57.6	57.7	57.4
Length of palatal floor	44.5	43.5	45.3	43.1
Lateral tooth-row	38.2	37.0	38.1	37.7
Breadth across molars	45.5	44.6	44.8	46.0

[1] *Mephitis mesomelas*, Oklahoma.

[2] *Mephitis mephitica*, Ft. Snelling, Minn.

[3] *Mephitis mephitica*, Ohio, Indiana and New York.

[4] *Mephitis estor*, Arizona.

[5] *Mephitis occidentalis*, British Columbia.

In regard to these measurements it may be said that females, as was well enough known before, average slightly smaller than the males ; they also prove to have, as a rule, a shorter mandibular ramus and a lower coronoid process, while the inter- and post-orbital regions of the skull are perhaps relatively slightly broader. In some cases individual variation nearly overlaps the sexual, but generally the differences in size and proportions in skulls from the same locality furnish a trustworthy clue to the sex of the specimens ; but in specimens of unknown origin from widely separated localities, it might be difficult to tell northern males from southern females, when both are specifically the same, there being apparently a marked decrease in size southward in all of the species.

Again, the difference in size and proportions is so slight in the different forms of the genus, and the range of individual variation so great, that perhaps no single character may be taken as invariably diagnostic, although the difference in the relative size of the teeth as compared with the rest of the skull will suffice to distinguish an eastern skunk from a western skunk, and the difference in general size will serve to give some clue to the habitat.

Note on the variability of coloration in the Skunks of the genus MEPHITIS.—In 1869 I referred to the common Skunk of the northeastern United States as one of the most variable animals, as regards coloration, to be found in North America, and described at length (Bull. Mus. Comp. Zoöl., I, No. 8, p. 179) the great amount of variation to be met with in Massachusetts specimens. This was apropos of Prof. Baird's opinion (Mam. N. Am., 1857, p. 195) that while the "species varies considerably in its markings," "individuals from the same locality are usually quite similar," his opinion being apparently based on a series of five specimens from Middleboro', Mass. It is unnecessary to repeat or even summarize the statements already on record in regard to the variability of Skunks in Massachusetts. It may be of interest, however, to supplement this with a few facts respecting the variability of Skunks at other localities.

As is well known skunk skins are extensively employed by furriers, being sold under various euphemistic names, as 'fitch,' 'American sable,' etc., and used in the manufacture of carriage robes, muffs and trimmings. Their market value depends largely upon their color, those with most white being least valuable, the price declining as the amount of white increases. Dealers usually separate the skins into four grades, the first being worth six or seven times as much as the fourth. The localities to which reference is here made are Vermont, Indiana and eastern New York.

I am indebted to Mr. Walter W. Granger, of this Museum, for important information about Skunks killed within a few miles of Rutland, Vt., which is to the following effect, the prices mentioned being those paid in 1893.

No. 1. Price, $1.40 per skin. Nearly all black, the only white being a small spot on the nape.

No. 2. Price, 90 cts. Nearly all black, but generally with small shoulder stripes in addition to the white nuchal patch.

No. 3. Price, 55 cts. With about the average amount of white, all of the usual white markings being fairly well developed.

No. 4. Price, 25 cts. Nearly the whole back white, forming a broad white mantle, with generally a narrow median line of black.

From a newspaper account entitled 'The Skunk-skin Harvest,' originally published in the Indianapolis, Ind., 'News,' in September, 1879, I take the following in relation to the skunk-skin trade in "central and southern Indiana," where one dealer is said to have "handled 20,000 skunk skins last year [1878], nearly all of which were caught in Indiana." The skins are classified in four grades, as follows:

"A No. 1, star skunk;" price, $1.75. All black except "a star-shaped white spot on the top of the head."

No. 2, the "short stripe;" price $1.25. This has a short white stripe running back from the nuchal patch on to the shoulder.

No. 3, the "narrow stripe;" price, 40 cts. This has a narrow white stripe on each side running back nearly to the tail.

No. 4; price, 20 cts. With a broad band of white on each side, three inches or more wide, and extending the whole length of the body.

I am indebted to Mr. William Wallace, also of this Museum, for the following information respecting 500 Skunks taken last year at Cobleskill, N. Y. (about fifty miles west of Albany), all killed within a radius of five miles:

No. 1, all black, except a white spot on the nape; price, $1.40; number of skins, 100.

No. 2, nearly all black; a short white stripe on the shoulders in addition to the white nuchal patch. Price, 80 cts; number of skins, 100.

No. 3, with the narrow white shoulder stripes extending a little further back. Price, 40 cts; number of skins, 120.

No. 4. The greater part of the back white, the lateral white stripes very broad and extending back nearly to the tail, separated generally by a narrow median band of black. Price, 20 cts.; number of skins, 180.

Mr. Wallace also informs me that an enterprising farmer in the Catskills has a successful 'skunk farm' in operation. For several years he has been raising Skunks for their oil and skins, and in order to improve the skins for the market, he is purchasing all the live Skunks, of either sex, of grade 1, he can obtain, in order to develop, if possible, a breed of black Skunks.

From the foregoing it is evident that the Skunks of at least Massachusetts, Vermont, eastern New York, and central and southern Indiana, are subject to a wide range of color variation, and it is probable that these localities are not exceptional in this respect. While data sufficiently numerous from other parts of the continent are mostly lacking, it may be of interest to mention the few at hand respecting the Skunks of Arizona.

Some years since a valued correspondent wrote to me of his experience with Skunks in Arizona. He says: "By the way, I do not believe in the wide range of individual variation usually accredited to the Skunks. In Arizona I had several unusual opportunities of examining all the young ones of a litter, and in each instance they were almost exactly alike. The Indians here skin (and eat!) a great many, and the variations are very slight indeed....[Here follows a description of the coloration, illustrated by diagrams, of the species Dr. Merriam had shortly before described as *Mephitis estor*.] In the Arizona skunk the only variable point is the amount of black in the middle line posteriorily, the white side stripes crowding it to a greater or less degree. In only one of several hundred specimens examined was the black entirely crowded out, the whole back and the whole upper side of the tail being white." A series of 8 specimens collected near Fort Verde, Arizona, so far as they go, bear out this statement. They agree perfectly with the original description of *Mephitis estor* Merriam (N. Am. Fauna, No. 3, Sept., 1890, p. 81).

On the other hand, a series of 15 specimens from a single locality in Pinal Co., Arizona, collected Nov. 13, 1886 to Jan. 23, 1887, by Mr. W. E. D. Scott, are as variable as can well be imagined, some being almost entirely without white markings, while in others the whole dorsal surface is nearly uniform white. Thus in No. 1357 the whole animal is black, except for a very narrow white frontal stripe, slight tufts of white hairs behind the ears, a narrow broken line of white on the right side, a few scattered white hairs on the left side, the extreme base of the tail hairs, and a long terminal pencil of white at the tip of the tail. In No. 1352 the whole back and the upper surface of the tail are white, except for a very narrow median line of black on the hinder part of the back. Between these two extremes there is a finely graduated series of intermediate stages. One (No. 1346) almost wholly lacks the frontal stripe, and has no trace of the nuchal patch, but there are narrow lateral white stripes, the one on the right side much heavier than the one on the left; the tail has a terminal white pencil, and the basal third of the hairs is white. Another (No. 1359) has a narrow frontal stripe, a very large nuchal patch, and a short narrow lateral white stripe on the left side, with the tail as in the last, except that the terminal pencil has nearly fallen out. Another (No. 1356) is like the last, except that the nuchal patch extends into a narrow white point to beyond the shoulders, and there is no white on the sides of the body. Another (No. 1350) has a well-developed frontal stripe, but the nuchal patch is nearly wanting; the lateral stripes are fairly well developed, but bifurcate anteriorly into two, one terminating just behind and below the ear, the other just above it. From this stage there is a gradual transition to those with a wholly, or almost wholly, white back.

Four specimens of the series have the posterior half of the white dorsal area grayish, through the admixture of many black hairs with the white ones. In four out of six of the blackest specimens the tail has a terminal pencil of very long white hairs (five to six inches in length), as in the eastern *M. mephitica*, and there is a trace of it in the other two. These are rather young (one-half to two-thirds grown) specimens. It seems therefore probable that in this species this long terminal pencil is a feature of youth, as it is absent in adult specimens. It is also possible that the Pinal County series is separable from the Fort Verde series, but satisfactory evidence of this is at present lacking. In the accompanying table of measurements, however, the two series were kept separate in computing the averages and ratios. The only difference seems to consist in the slightly smaller size of the Pinal County series, which also averages younger, so that this slight difference may be doubtless safely attributed to the average difference in age between the two series.

29. Spilogale indianola *Merriam.*

Spilogale indianola MERRIAM, N. Am. Fauna, No. 4, Oct. 1890, p. 10; ALLEN, Bull. Am. Mus. Nat. Hist. III, pp. 219, 308 (Tamaulipas, Mexico, and Corpus Christi, Texas).

This species is represented by five Texas specimens and one from Tamaulipas. Four of the Texas specimens are in Mr. Attwater's collection, and were taken in the immediate vicinity of Rockport. One is a very young example, which differs in color from the adults only in the white markings being pure white instead of more or less creamy white.

The series is very uniform in coloration, and leaves nothing to be added to the descriptions I have already given (l. c.) based on the Corpus Christi and Tamaulipas specimens.

Mr. Attwater refers to them as rare, and says he knows little of their habits. He has met with them only on the peninsulas, and does not know whether they are to be found on the islands.

30. **Putorius brasiliensis frenatus** (*Licht.*). BRIDLED WEASEL.—Unrepresented in the collection, but Mr. Attwater reports it as of occasional occurrence in Aransas County, and says one was recently taken near Rockport.

31. **Canis latrans** *Say.* COYOTE.—No specimens were sent, but Mr. Attwater furnishes the following interesting notes :

"Still common on the prairies inland, and often seen in parts of Aransas County. They are frequently seen from the car windows in passing on the railway in San Patricio County. They are disturbed in the early morning by passing trains from their feast on the dead carcasses of animals killed by being knocked off the track. They do not seem to mind the cars much, as they only slink off for about fifty yards and sit up waiting for the train to pass. In this position they become targets for the trainmen, who shoot at them with revolvers. Several persons have told me that while watching for turkeys they have observed Coyotes catching grasshoppers."—H. P. A.

32. **Urocyon virginianus** (*Schreber*). GRAY FOX.—Represented by a single imperfect skin, loaned by Mr. Attwater for examination.

"I have the skin of one of these little foxes, which was brought to me in 1892. It was killed on Live Oak Peninsula, about six miles from Rockport. These foxes are common inland. I think they subsist largely on the Texan Bobwhite (*Colinus virginianus texanus*), as do also the wild cats, throughout southwest Texas. I have frequently come across bunches of the feathers of the Bobwhite: These animals easily scent them out during the night. The Bobwhite has become quite scarce in Aransas County, of late years, and I attribute the rare occurrence of foxes and some other animals here to this cause."—H. P. A.

33. **Lynx rufus maculatus** (*Horsf. & Vig.*). WILD CAT.—Two specimens received from Mr. Attwater are provisionally referred as above. Mr. Attwater states that they are still found occasionally in Aransas County.

34. **Felis onca** *Linn.* Jaguar.—Now extirpated. "Captain Bailey says he formerly owned a fine skin of a Jaguar killed on the point of Live Oak Peninsula by J. J. Wealder and A. Reeves, in 1858, but has not heard of any in this neighborhood since."—H. P. A.

35. **Felis concolor** *Linn.* Panther.—"Captain Bailey tells me the Panther was common here twenty-five years ago, and remembers riding right on to one, in the long prairie grass on Capano Bay, about 1857. It was in the act of devouring a deer which it had killed."—H. P. A.

36. **Felis pardalis** *Linn.* Ocelot; Leopard Cat.—"These used to be occasionally found in Aransas County. The last one was killed several years ago by Levi Phillips and William Tally a few miles from Rockport in the brush. I received this information from Capt. N. C. Phillips, a well-known farmer now living in Aransas County."—H. P. A.

Article VII.—FOSSIL MAMMALS OF THE LOWER MIOCENE WHITE RIVER BEDS. COLLECTION OF 1892.

By HENRY FAIRFIELD OSBORN and J. L. WORTMAN.

With two Plates and eight figures in Text.

INTRODUCTORY NOTE.

The reports from the Department of Mammalian Palæontology in the American Museum are published in two series. The *Faunal series* includes at present the *Wahsatch Fossil Mammals*, the *Cretaceous Fossil Mammals*, and the present *Lower Miocene Fossil Mammals*, Part I. This series is designed to cover the entire Museum collections from certain horizons, and not only to include descriptions of new forms, but to serve as a descriptive guide to the collection for the use of specialists. The *Special series* includes preliminary notices of important types which it is advisable to publish promptly. In the latter series four papers have already been devoted to the Lower Miocene Collection of 1892, namely: upon *Protoceras*;[1] upon *Artionyx*,[2] which Scott has now shown to be identical with *Agriochœrus* Leidy; upon the *Divisions of the Lower Miocene*;[3] upon *Aceratherium tridactylum*;[4] and upon *Ancestors of the Tapir*.[5]

The present is the first part of a report belonging to the 'faunal series,' and covers part of the fossils collected in 1892. More recent collections and the remainder of this will be treated in a second part. These collections were made by Dr. Wortman, assisted by Mr. Peterson and Mr. Gidley.

The most novel points in the present paper are:

1. New characters of the Lower Miocene Rhinoceroses, including two new types, *A. trigonodum* and *A. platycephalum*.
2. The osteology of *Metamynodon*.

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[1] Osborn and Wortman, Bull. Am. Mus. Nat. Hist., Vol. IV, Dec. 30, 1892.
[2] Loc. cit., Vol. V, Osborn and Wortman, February, 1893.
[3] Loc. cit., Wortman, June 27, 1893.
[4] Loc. cit., Osborn, April 29, 1893.
[5] Loc. cit., Wortman and Earle, August 18, 1893.

SUCCESSION OF SPECIES IN THE WHITE RIVER MIOCENE.

Approximate estimate of the thickness of the Beds.	General Character of Rock.	Types appearing for Last Time, Italicized
PROTOCERAS BEDS. 100 feet.	Leptauchenia Layer: nodule-bearing, pink-colored clays.	Pogonodon sp. ? Eporeodon major, Leptauchenia sp., Aceratherium tridactylum, *Hyracodon*, Hyænodon ?
50–75 feet.	Coarse sandstones, not continuous.	Hyracodon sp., Aceratherium tridactylum, Aceratherium platycephalum, Diceratherium proavitum, Protapirus obliquidens, *Mesohippus bairdii*, Mesohippus sp., Elotherium imperator, Thinohyus sp., Anthracotherium karense, Hyopotamus brachyrhynchus, Protoceras celer, Agriochœrus gaudryi, Pogonodon sp. (?)
BARREN CLAYS. 100 feet.	Light-colored clays.	A few scattered mammalian remains.
OREODON BEDS. 75 to 100 feet.	Nodulous clay stratum. Bones white.	Oreodon bullatus, Hyænodon crucians, H. cruentus, Daphænus, Palæolagus haydeni, Ischyromys typus, Leptictis haydeni, *Metamynodon*, Leptomeryx evansi, Hyracodon, Poëbrotherium wilsonii, *Aceratherium occidentale*, Dinictis felina, Hoplophoneus primævus.
	Sandstones and clays. Bones rusty colored.	Aceratherium occidentale, Mesohippus bairdii, Hyracodon sp., Elotherium imperator, E. mortoni.
10 to 20 feet.	Oreodon Layer: nodule-bearing. Bones with scale of ferruginous oxide. 'Red layer.'	Hyracodon sp., Aceratherium mite, Aceratherium occidentale, Mesohippus bairdii, Colodon luxatus, Protapirus simplex, Elotherium mortoni, Elotherium imperator, Anthracotherium occidentale, Hyopotamus americanus, Poëbrotherium wilsonii, Leptomeryx evansi, *Oreodon culbertsonii*, *Oreodon gracile*, Hoplophoneus primævus, Hoplophoneus occidentalis, Hyænodon horridus, Hyænodon paucidens, Hyænodon crucians, Hyænodon cruentus Daphænus, Ischyromys sp., Palæolagus haydeni.
50 feet.	Metamynodon Layer: sandstones and clays. Bones rusty. Reddish gritty clay. Bones white.	Hyracodon sp., *Aceratherium mite*, Metamynodon planiceps, Oreodon culbertsonii, Mesohippus bairdii, Hoplophoneus primævus, Elotherium mortoni, Elotherium imperator.
TITANOTHERIUM BEDS. [illegible]	Mingled remains of Titanotherium, Aceratherium, Mesohippus.	*Aceratherium trigonodum*, Mesohippus bairdii, Anthracotherium occidentale, Elotherium mortoni (?), Oreodon culbertsonii (?), *Titanotherium*.

3. The basi-occipital characters of *Oreodon* as developed in successive horizons.
4. The determination of two species of *Anthracotherium.* Additional characters of the American *Hyopotamus.*

The section upon the Perissodactyla was mainly written by myself; that upon the Artiodactyla and Carnivora by Dr. Wortman. Authors, in citing this paper, are requested to kindly recognize the names of both contributors.—H. F. O.

FAUNAL SUCCESSION IN THE LOWER MIOCENE.

One of the most important features of the field work of the Expedition of 1892 was a very careful survey of the complete section of the Lower Miocene beds in South Dakota. Wortman has already published a preliminary table of the succession of strata,[1] and we now add a preliminary list of the succession of species. This will naturally be subject to revision; some species will be found to occur upon higher or lower levels, and the list characteristic of each level will be greatly increased. In the meantime the following list will furnish the basis for definite criticism and revision, and taken together with the admirable work of Scott upon the Deep River beds, and of Hatcher upon the lower section or Titanotherium beds, is a step towards the still more exact stratigraphical and faunal work of the future.

Suborder PERISSODACTYLA.

Family RHINOCEROTIDÆ.

Aceratherium trigonodum, sp. nov.

PLATE II, *A*.

This species is the oldest of the series, and is named from the strictly triangular form of the last upper premolar. The best specimen is a nearly perfect skull (No. 529) with one jaw found in the uppermost 'Titanotherium layer.' The type specimen (No. 528) is a perfect set of upper grinders of both sides, only partly worn.

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[1] 'On the Divisions of the White River or Lower Miocene of Dakota,' Bull. Am. Mus. Nat. Hist., V, pp. 95-106, June 27, 1893.

The specific characters are: Dentition, $\frac{?}{1}$, $\frac{?}{1}$, $\frac{4}{3}$, $\frac{3}{3}$. (*a*) *Upper canine* apparently persistent and well developed. (*b*) *Upper premolars* subtriangular; third premolar with an incipient postero-internal cusp, well developed towards the base; fourth premolar with a feeble or incipient postero-internal spur and a somewhat prominent elevation of the postero-internal cingulum, which presents the appearance of a 'cingule' when worn. (*c*) *Upper molars* with well-developed internal cingulum upon protoloph; cingulum feeble or absent on metaloph; incipient 'antecrochet' at base of metaloph becoming apparent upon wear. (*d*) *Skull* (No. 529) fairly elevated; sagittal crest low; nasals rather short, not notched; postglenoid and posttympanic processes widely separated.

The canine associated with specimen No. 529 was not found *in situ*, and is therefore open to some question; it is larger than

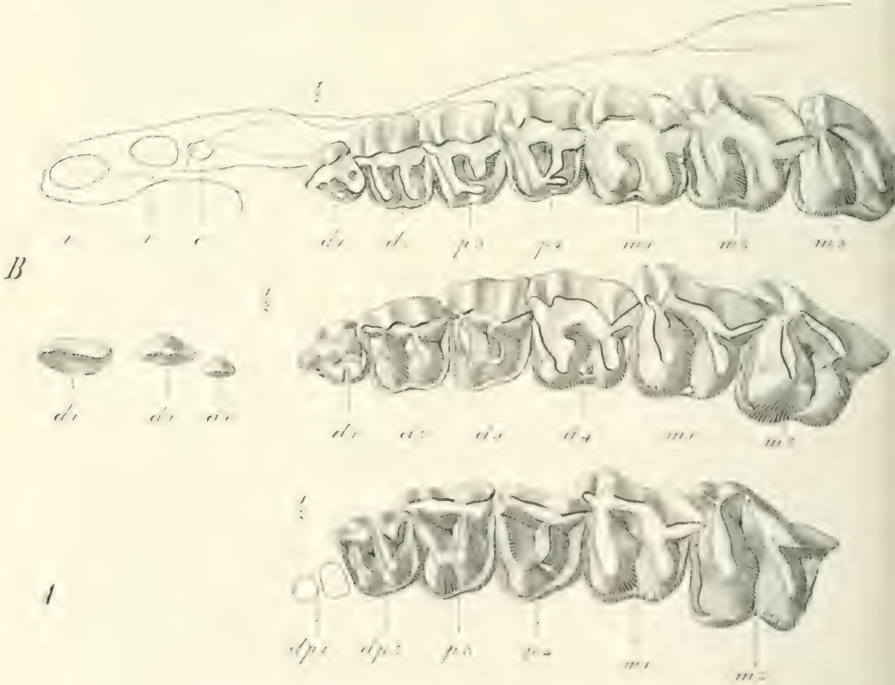

Fig. 1. Upper dentition of the left side of: A, *Aceratherium trigonodum*, type (No. 528). B, *Aceratherium mite*, showing immature dentition (No. 521). *Aceratherium mite*, showing mature dentition (No. 522). One-half natural size.

that of *A. mite.* The lower jaw is long and slender; it lacks any trace of the first premolar; the lower canines differ from those of *A. occidentale* in being fully procumbent. The nasals are relatively shorter and more obtuse than in *A. mite;* the sagittal crest is less sharply defined. The postglenoid processes extend more widely behind the glenoid fossa than in the later types.

Aceratherium (Cœnopus) mite *Cope.*

PLATE II, *B.*

This species has been hitherto known chiefly in its teeth and skeletal characters, from the descriptions of Cope. It is represented by three beautifully preserved skulls, one containing the complete milk dentition (No. 521), the others containing the adult dentition in two stages of wear (Nos. 522, 524). Found at the base of the 'Oreodon Beds' (Nos. 521, 522), and in the 'Metamynodon layer' (No. 524).

The specific distinctions of the skull region are: Dentition, $\frac{2}{}$, $\frac{1\text{-}0}{}$, $\frac{4}{}$, $\frac{3}{}$. (*a*) Small *upper canines* present in milk series, and temporary or absent in permanent dentition. (*b*) *Upper premolars:* third premolar subtriangular with a small but well-defined postero-internal cusp (tetartocone), and a short posterior crest; fourth premolar subtriangular with a somewhat feebler tetartocone. (*c*) *Upper molars* with more or less well-defined internal cingula, especially upon the protoloph, 'antecrochet' usually distinct upon first molar and feeble or absent upon second and third molars; third molar with ectoloph and metaloph completely confluent. (*d*) *Skull* rather broad and low; sagittal crest well-defined posteriorly; occiput of medium height; frontals broad and somewhat rugose above postorbital processes; nasals notched laterally and sharply pointed; postglenoid and posttympanic processes separate.

These skulls are small and delicate, about 17 inches in length. The general impression one receives is of considerable lateral and moderate vertical extension. The premaxillaries are not overhung by the nasals, and are completely separated in the median line. Seen from above, the nasals, pointed at the tip, widen suddenly as in *Hyrachyus*, with which generic type *A. mite* presents many striking resemblances. The skull gradually broadens to a point above and slightly behind the orbits, then contracts into the rather broad, low cranium. The premaxillaries are almost in contact with the nasals.

The younger individual (No. 521) shows all the upper premolars of the *first series* in place. The first premolar has a long ectoloph and two irregular transverse crests. The second premolar has two perfect transverse crests. The third premolar has two crests which are confluent internally; it is more triangular in form and less progressive than the second premolar. The fourth premolar is on the other hand more progressive than the molars, with protoloph and metaloph, an antecrochet and a tubercle at the entrance of the median valley. It is somewhat doubtful whether the incisors and the canine belong to the first or second series.

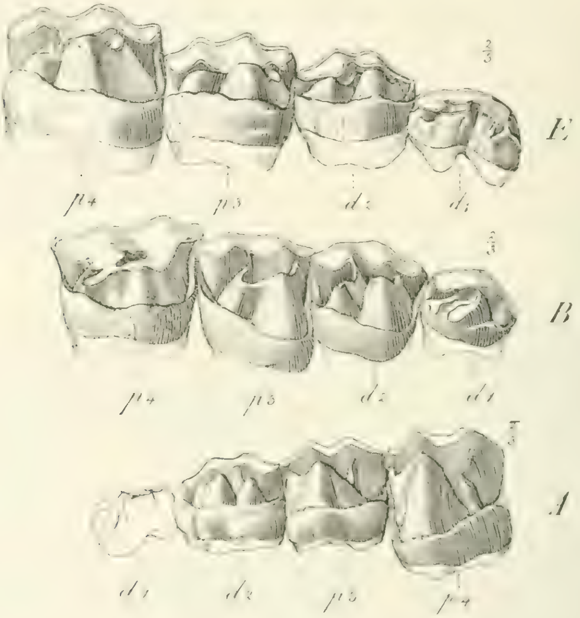

Fig. 2. Adult Upper Premolars of the First and Second Series A, *Aceratherium trigonodum*, type (No. 528). B, *Aceratherium mite* (No. 522). E, *Aceratherium platycephalum* (No. 549). Showing by the internal view the persistence and unchanged form of the two 'milk' teeth, D. 1 and D 2, and the evolution of the postero-internal lobe in the third and fourth premolars, P. 3, P. 4. Two-thirds natural size.

Aceratherium occidentale (*Leidy*).

Plate II, *C.*

This classic species is represented by numerous specimens, including three fairly well-preserved adult skulls (Nos. 532, 535, 537), and one perfect baby skull and jaws (No. 534). It seems to occur chiefly above the 'Metamynodon layer' in the middle and upper divisions of the 'Oreodon Beds.'

The specific distinctions are: Dentition, $\frac{2}{2}$, $\frac{0}{1}$, $\frac{4}{4-3}$, $\frac{3}{3}$. (*a*) *Upper canines* wanting in deciduous and permanent series; lower canines with crowns of medium length, semiprocumbent. (*b*) *Upper premolars:* third premolar subquadrate, with strong tetartocone and posterior crest not quite in contact in the unworn condition; fourth premolar transitional to subquadrate with feebler development of tetartocone and posterior crest. (*c*) *Upper molars:* internal cingula fairly well defined, especially upon protolph; 'antecrochet' well developed upon first and second molars, and sometimes present upon third molar; third molar with ectoloph and metaloph completely confluent. (*d*) *Skull* rather high and narrow; nasals long, well developed and slightly notched; sagittal crest flattening out except in posterior region of cranium; postglenoid and posttympanic processes approximated but not actually in contact; occiput elevated; paroccipital processes very long and slender.

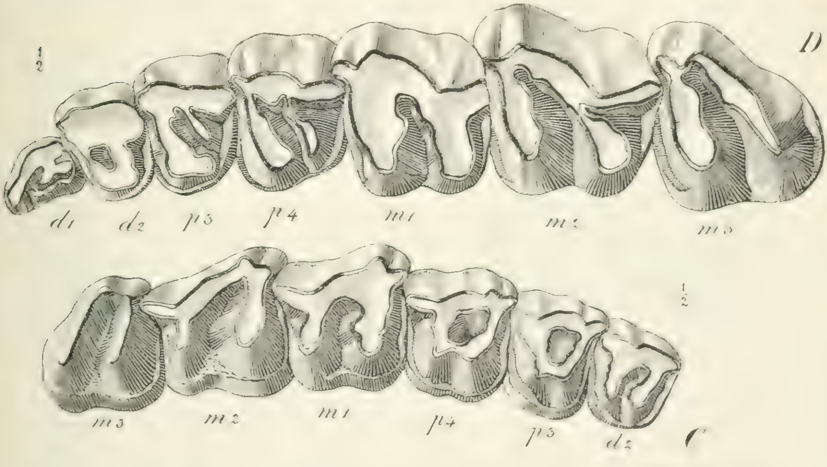

Fig. 3. Adult Upper Dentition of C, *Aceratherium occidentale* (Leidy) (No. 535), and of D, *Aceratherium platycephalum*, type (No. 545). One-half natural size.

The immature skull (No. 534) is doubtfully referred to this species. In contrast with the young *A. mite* it exhibits a feeble pair of upper incisors, and no trace of the upper canines. The four deciduous premolars are the only grinding teeth present; they are all completely molariform, with two complete crests, except D. P. 1, which exhibits a strong postero-internal cusp and a very feeble posterior crest. There is a 'crista' upon D. P. 2.

Aceratherium platycephalum, sp. nov.

Plate II, *E*.

The type of this species is a skull and lower jaw (No. 545) from the coarse sandstones or lower section of the 'Protoceras Beds,' on the same level with *A. tridactylum*. Belonging to the same species is a perfect set of upper premolars and molars of the right side (No. 540).

The specific distinctions are as follows : Dentition, $\frac{?}{2}, \frac{0}{0}, \frac{4}{4-3}, \frac{3}{3}$. (*a*) Third and fourth *upper premolars* with prominent postero-internal cusps (tetartocones) which when unworn are quite separate from the delicate posterior crests ; third premolar quadrate ; fourth premolar subquadrate. (*b*) Internal cingula upon true *upper molars* wanting ; first molar exhibits an 'antecrochet' ; third molar exhibits a depression on the posterior face at the junction of the ectoloph and metaloph. (*c*) Large procumbent lower canines, with a small median pair of incisors. (*d*) *Skull* flattened, obtuse nasals, slight postglenoid-posttympanic contact ; broad, low occiput ; sagittal crest wanting and represented merely by two low, divergent *linea aspera* about one inch apart.

Both specimens (Nos. 545, 540) belong to a large animal. The skull is about 25 inches in length, and is wholly different in its proportions from that of the contemporary *A. tridactylum*, which is of the high narrow type, and about 20 inches in length. The prominent bosses above the postorbital processes, the short obtuse nasals, the very large horizontal lower incisors, or canines, the flattened upper surface of the cranium, are all characters which immediately distinguish this type. The proportions of the skull suggest that this species may have succeeded the *A. mite* Cope.

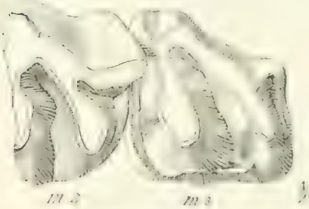

Fig. 4. Second and third upper molars of *Aceratherium simplicidens* Cope, type. One-half natural size.

The last upper molar is somewhat similar in form to that of *A. simplicidens* Cope.

Aceratherium tridactylum *Osborn*.[1]

Plate II, *E*, and Plate III.

This species was founded upon the remarkably complete skeleton represented in Plate III. Other remains are a fine skull

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[1] Bull. Am. Mus. Nat. Hist., Vol. V, April 20, 1893, p. 85.

(No. 541), and many fragmentary portions of the skeleton. Found in the coarse sandstones or lower division of the 'Protoceras Beds.'

The specific distinctions are: Dentition, $\frac{2}{1}$, $\frac{0}{1}$, $\frac{4}{3}$, $\frac{3}{3}$. (*a*) The *upper premolars* cannot be clearly defined at present, owing to the adult wear. (*b*) Internal cingula upon *upper molars* faintly developed or wanting; first, second and third molars with strong 'antecrochet.' (*c*) Semiprocumbent lower canines. (*d*) *Skull* elevated, elongate nasals, broad postglenoid-posttympanic contact, high occiput, powerful sagittal crest.

The following paragraph is from the original description of the type specimen:[1] "The skeleton measures seven feet nine inches in length, and four feet in height to the top of the lumbar vertebral spines. There are nineteen dorsal, five lumbar and three sacral vertebræ. The pelvis is long and rather slender, and the limbs are of an intermediate type, heavier than in *A. occidentale* and much longer than in the Upper Miocene *A. fossiger*. There are only three digits in the manus, hence the name *tridactylum*, there being no trace of the fifth digit, which is so characteristic of the Lower Miocene Rhinoceroses of America and Europe, with the possible exception of *A. mite* Cope."

In the type the nasals are perfectly smooth, but in another skull (No. 541) the nasals exhibit a pair of rugosities which at once suggest the possession of a pair of horns, and Mr. Hatcher[2] has recently shown that this species is followed by another, related to the John Day genus *Diceratherium* Marsh. The distinctive features of the skull are the high, narrow occiput, and powerful sagittal crest, the arching and rugose nasals overhanging the premaxillaries, the posterior lateral projections of the zygomatic arches, the widely united postglenoid and posttympanic processes. The dentition is characterized by the medum sized semiprocumbent lower canines, and by the strong 'antecrochet' upon the upper molars.

GENERAL FEATURES OF THE LOWER MIOCENE RHINOCEROSES.

PLATES II AND III.

From these observations it appears that there was a very rapid evolution both in form and in size among the Lower Miocene

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[1] Loc. cit.

[2] American Geologist, May, 1894, p. 360.

Rhinoceroses, also that there was considerable variety and a number of parallel lines of species. The succession in *time* is : *A. trigonodum*, *A. mite*, *A. occidentale*, *A. tridactylum*, and *A. platycephalum*. The relative appearance in time of *A. simplicidens* Cope and *A. pumilum* Cope has not been ascertained, nor do we understand as yet the phyletic succession of any of these species.

The transformation of the upper premolars is particularly interesting : first, in the retention of the D. P. 1 and D. P. 2 as permanent teeth, the latter exhibiting fully molariform transverse crests ; second, in the more rapid evolution of the third premolar than of the fourth premolar. Quite the reverse of this is the case in the horses, where the fourth premolar is more progressive than the third.

The discovery of *A. tridactylum* and of *A. platycephalum* was quite unexpected. The former may connect with *Diceratherium* through the *D. proavitum* of Hatcher. The latter is an altogether unique form, as it resembles none of the later Miocene types thus far discovered. The distinctive features of the skull evolution are well shown in Plate II.

Family AMYNODONTIDÆ *S. & O.*

In this family of aberrant Rhinoceroses are included the genera *Amynodon*, *Metamynodon*, and possibly *Cadurcotherium*, a European form which presents many analogies to the American Amynodonts. The previous family definition given by Osborn may now be amended as follows :

> Large upper and lower canines. Upper and lower incisors reduced in number, and of a uniformly small size. Premolar series in both jaws greatly reduced. Last upper molar with a complete ectoloph. Skull with a short facial region and powerful sagittal crest. Functional digits 4–3. Lunar wedge-shaped distally.

We are now enabled to fully compare these animals with the Rhinocerotidæ, the most striking differences being in the peculiar form of the skull, the great canine tusks, and the four functional toes in front. Very numerous minor differences run throughout the dentition and skeleton, and indicate ancient divergence from the Rhinoceros stem.

Restoration.—The most complete individual, which we refer to *M. planifrons*, gives us all the proportions of the body. The adult was about 9½ feet long and 4½ feet high at the shoulders, with a low, compactly built body, muscular limbs and deep chest. The vertebral spines were not elevated. Thus the general appearance of the animal, with its low, broad skull, widely spreading zygomatic arches and tusks, was widely different from the contemporary *Aceratherium* with its light build, feeble canine tusks and high, narrow skull.

Metamynodon planifrons *S. & O.*

All the specimens in the collection (Nos. 546–554) are provisionally referred to this species. The variations in size and dental formulæ do not afford the basis for specific separation from the type at present.

The material collected in 1892 embraces remains of nine individuals, as follows: *A*, from *Metamynodon stratum:* No. 546, greater part of skeleton, fragments of skull, lower jaw complete, lacking pelvis and lumbars; No. 547, skull; No. 549, lower jaw; No. 550, lower jaw of young individual, with milk teeth; No. 551, jaws of young individual; No. 552, fragmentary lower jaw; No. 553, complete lower jaw. *B*, from *Upper Oreodon stratum:* No. 548, fore limb; No. 696, lower jaw.

SKULL AND LOWER JAWS.

The osteology of the skull has already been fully described; the lower jaws are long and not very deep; the condyle is elevated, with great transverse and slight antero-posterior section. The coronoid is slender; the border of the angle is thickened as in *Rhinoceros*. The symphysis is long and horizontal with a single mental foramen.

Dentition.—The dental formula as given by Scott and Osborn requires modification, as there is evidence that the number of incisors is less than stated by them. In skull No. 555 there are three upper incisors upon one side and two upon the other. Of the lower jaws, Nos. 551 and 546 present two incisors upon each side, while No. 555 has but a single incisor upon each side. There are three upper premolars and two lower premolars as a number constant in all the specimens. The dental formula should therefore be written I. $\frac{3-2}{2-1}$, C. $\frac{1}{1}$, Pm. $\frac{3}{2}$, M. $\frac{3}{3}$. The *incisors* are subfunctional, being better developed than appeared in the Harvard College type skull. The most exceptional feature is the large *canine* tusks, which are 3½ inches in length in the lower jaw, and 2 inches in length in the upper jaw. The lower canines are strongly recurved, trihedral in section, with posterior faces worn flat by close friction with the anterior faces of the upper canines. Both pairs of tusks diverge, and are outwardly curved like those of the wild boar. The *premolars* are characterized by extreme reduction in size, the antero-posterior diameter of the entire premolar series being less than that of the second true molar. They also show a limited assumption of the molar pattern, as has been already pointed out. The *upper molars* are distinguished by the flattened external face of the ectoloph, which in M. 3 is carried well beyond the metaloph, a feature which is very rare in the true Rhinoceroses. There is a trace of the 'crista' in M. 2 in one specimen (No. 547.) There is no internal cingulum, and the transverse crests are devoid of either the crochet or antecrochet.

The *lower molars* are remarkable for their extremely high, elongate and laterally compressed crowns, which exhibit a tendency to a prismatic or hypsodont structure. The anterior crest is strongly and sharply incurved. In the molars of Nos. 550, 555, 546 a prominent tubercle appears at the entrance of the posterior valley. The third molar has only two lobes, as in the true Rhinoceroses.

The Skeleton.

Vertebræ.—The following description refers exclusively to No. 546, unless otherwise specified. The atlas indicates powerful transverse processes; the suboccipital foramen perforates the anterior part of the arch. The axis is rather elongate, and exhibits an obtuse odontoid process. The remaining cervicals have strongly opisthocœlous centra, with oval faces, the greatest diameter being transverse; the zygapophyses are large and slightly oblique; the neural spines are not preserved; the seventh cervical is imperforate, and its centrum shows a facet for the first rib. Fifteen *dorsals* are preserved. The first dorsal has a broad descending lamella from the transverse process with a facet for the tuberculum of the first rib; the capitulum of the first rib articulates at the anterior base of the process. The succeeding dorsals lack the lamella; the adjacent facets for the capitulum of the rib become confluent between the third and fourth dorsals; the capitulum is supported on adjacent facets between each pair of vertebræ as far back as the 15th dorsal. The tubercular facet is also exhibited upon the 15th dorsal, the last one completely preserved. The zygapophyses are very small, and are horizontal in position from the first to the 11th dorsal, when they begin to take an oblique position; in the 15th they are considerably rounded and obliquely placed. The dorsal spines are not very elevated in the mid-dorsal region, and they sink rapidly towards the posterior end of the series; they have a trihedral section; they are keeled anteriorly, and deeply excavated posteriorly from D. 3 to D. 12, where the upper portion of the spine assumes the broad flattened form characteristic of the lumbars. No vertebræ are preserved behind the 15th dorsal except five of the caudals.

Ribs.—Fourteen ribs of the right and six of the left side are preserved, indicating that there was a deep, rather narrow chest. The first rib has an oval section above and is flattened below. The 2d to the 7th ribs have flattened shafts; the ribs from the 8th to the 14th pass from a trihedral to a rounded section. From the length of the ribs it is estimated that the depth of the chest was about 35 inches.

Scapula.—Of the scapula only the lower portion is preserved. It exhibits a shallow glenoid fossa, a low rugose corocoid process.

Humerus.—The humerus is massive, with prominent greater and lesser tuberosities, a rugose deltoid crest slightly retroverted, but not hooked, extending half-way down the shaft. The ectepicondyle is very prominent, and there is a supratrochlear foramen. The internal condyle is perfectly flat. The relative measurements of the humerus and the radius are 16 in. to 13 in.

Radius.—The radius has a characteristic pit on its front face just above the insertion of the *brachialis anticus;* the shaft is flattened, and distally presents a very strongly concavo-convex face for the scaphoid, and slightly concave face for the lunar.

Ulna.—The ulna has a short olecranon, a trihedral shaft and a prominent rugosity on the median external face ; distally there is a deep groove upon the anterior face for the passage of the extensor tendon ; it rests partly upon the lunar as well as upon the cuneiform.

The *pelvis* is wanting.

Hind Limbs.—The hind limbs are characterized by the great length of the femur in proportion to the tibia—the ratio being femur, 19 inches ; tibia, 11 inches. The head of the *femur* has a large pit for the *ligamentum teres*, a prominent rugose great trochanter which does not rise above the head ; a shallow digital fossa ; the lesser and third trochanters are low and placed well down upon the shaft ; the rotular groove faces obliquely downwards, indicating that the knee was carried well up ; the external and internal tuberosities are equal ; the external condyle is the largest. The *tibia* has a double spine, a broad cnemial crest, which exhibits a deep median superior depression ; the internal malleolus is not prominent, and the astragalar trochlear, as in *Aphelops*, is shallow. The *fibula* is complete although reduced, with an expanded distal extremity ; the shaft is trihedral in section and not laterally compressed.

Manus.—The manus exhibits the articulations and relations invariably associated with tetradactylism, viz. : the lunar is wedge-shaped distally, and is supported equally upon the magnum and unciform instead of mainly upon the unciform, as in the Rhinoceros and in tridactyl types generally. The bones of the proximal row are in other respects similar to those in *Rhinoceros*. The distal row shows a small trapezium ; the second digit being supported by the trapezoid and abutting against the magnum ; the third and fourth digits articulate with the magnum and unciform in the usual manner, and the fifth is well developed, as indicated by a broad horizontal unciform facet. The larger specimen (No. 548) from the "upper Oreodon stratum" exhibits a third digit and a large fifth digit fully as functional as in *Titanotherium*, and more strongly developed than in the Tapir.

Pes.—The pes is remarkable especially for the form of the tuber calcis, which is elongate, flattened, expanded distally, and has its long axis placed nearly transversely instead of antero-posteriorly. The cuboid has a larger astragalar than calcaneal facet, while the astragalus itself is very short. The middle metapodial abuts against the cuboid. As a whole the pes is very short.

In addition to the points above noted, *Metamynodon* is distinguished from the modern Rhinoceros by a lesser development of the humeral tuberosity and of the third femoral trochanter, by the elongated neck for the head of the femur, and by the shortness of the astragalus. Upon the whole, however, it is much more advanced and specialized in the direction of the modern Rhinoceros type than the contemporary *Aceratherium occidentale.*

Family EQUIDÆ.

Subfamily ANCHITHERIINÆ.

CHARACTERS OF THE LOWER MIOCENE SPECIES OF HORSES.

The typical form, *Mesohippus bairdii*, extends apparently unmodified in form and very slightly increasing in size from the lowest to the highest beds, while just above the Oreodon strata a distinct and much larger form appears, and in the highest strata (Protoceras Beds) a second larger type appears transitional to the John Day *Anchitherium.* We thus observe the *persistence of primitive species of Horses contemporary with divergent progressive species* as a characteristic of the evolution of the Horses. This is in accord with the previous observations of Marsh, confirmed by Scott and Osborn, that a form *? Anchitherium parvulus*, which is very slightly removed in dental characters from *Mesohippus*, occurs even in the top of the Miocene (Loup Fork);[1] also with Scott's recent observations upon the polyphyletic series of the upper Miocene (Deep River) Horses of North America.

Mesohippus bairdii (*Leidy*).

This well-known species is represented by remains of sixteen individuals—Nos. 664-677, 712, 713—chiefly from the 'Oreodon' and 'Metamynodon' strata, including all parts of the skeleton and of the dentition excepting the incisor teeth. Among the most valuable specimens for morphological study is the nearly complete skeleton of a young individual, No. 685.

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[1] See Scott and Osborn, Bull. Mus. Comp. Zoöl., 1890, p. 89.

INCERTÆ SEDIS.

? **Mesohippus longipes,** sp. nov.

The type of this species is a complete hind limb (No. 684), found just above the 'nodular layer' in the sandstones and clays of the upper 'Oreodon beds.'

It presents certain points of likeness with the hind limb of *Hyracodon nebrascense*, as well as with that of the *Miohippus annectens*, recently described by Scott from the 'Deep River Beds' of Montana, which lie at the base of the Loup Fork or Upper Miocene.[1] In other words, if really a Horse it is a much larger and more modernized type than the *M. bairdii.* The animal stood about 31 inches high at the hip, while *M. bairdii* stood 21 inches high.

The pelvis is similar to that of *M. bairdii*, so far as we can determine from the small portion preserved. The femur has a deep pit for the *ligamentum teres ;* the great trochanter is missing ; the third trochanter is placed higher upon the shaft than the second. The tibia has a greatly elevated cnemial crest. The fibula is reduced to a continuous extremely slender shaft closely applied to the side of the tibia. The calcaneum has a long tuber calcis, and displays a small fibular facet ; the ectal superior calcaneo-astragalar facet is separate, while the ental and inferior facets are continuous, thus differing widely from the separate facets of *M. bairdii*, and resembling those of *H. nebrascense.* On the other hand the astragalo-tibial grooves of the ankle joint are much sharper than in any known species of *Hyracodon* and resemble those of the Horses. The cuboid articulates with the astragalus by a very narrow facet as in both the Horses and Hyracodons. The navicular displays a deep postero-external facet for the cuboid. The ectocuneiform is very deep with an external facet for metatarsal IV. The mesocuneiform is short. The entocuneiform has a small navicular facet.

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[1] 'The Mammalia of the Deep River Beds,' Trans. Am. Phil. Soc., Vol. XVII, May, 1894, p. 8[illegible]

The toes spread distally; the lateral pair are relatively larger and more oval in section than in *M. bairdii.* The proximal phalanges are much longer relatively than in the typical Horses. Altogether it is very doubtful where this animal belongs. It is widely distinct from both the known lower Miocene Horses and Hyracodons.

The specific characters are: (*a*) Metatarsals 3, long and slender, slightly spreading distally. (*b*) Sustentacular and inferior calcaneo-astragalar facets continuous. (*c*) Astragalo-tibial grooves sharp. (*d*) Fibula complete, but greatly reduced and closely applied to tibia.

Suborder ARTIODACTYLA.

Family OREODONTIDÆ.

An unusually fine series of skulls of the Oreodonts from all levels of the White River formation enables us to add something to the knowledge of the vertical distribution of the species. It has been stated at various times that remains of Oreodonts occur in the lower Titanotherium Beds, but careful search in the region explored by our party, viz.: the divide between the White and Cheyenne Rivers, has failed to bring to light a single specimen of the group from these underlying strata. All the specimens in our collection were found in the Oreodon and Protoceras Beds, or middle and upper divisions.

Oreodon culbertsonii *Leidy.*

Remains of this species are exceedingly abundant in the lower 'nodular layer' of the 'Oreodon Beds'; it is from their relative abundance in this stratum that this primary division of the White River sediments takes its name. The typical nodular layer, in which their remains are especially numerous, lies within fifteen or twenty feet of the top of the Titanotherium strata, and it is not an unfrequent occurrence to find them also in the clays immediately overlying the Titanotherium Beds; in fact it is highly probable that the species has been found in the extreme uppermost layers of the Titanotherium Bed proper.

So far as our collection shows, the vertical range of *O. culbertsonii* does not exceed thirty feet, extending from the top of the Titanotherium Beds, upwards some distance above the lower nodular or 'red layer.' It is probable, however, that more extensive collections will increase this limit considerably both above and below.

The principal characters of this species are seen in the very small, uninflated tympanic bullæ, the form of the paroccipital processes, and the presence of a distinct and separate foramen rotundum. In the absence of any accurate description of this region of the skull, it is here treated in some detail for purposes of comparison with later types. The specimen described and figured is No. 595. The bullæ are small and rugged in contradistinction to the large, smooth, rounded form found in the later species. The paroccipital processes are rather elongated, more or less triangular in section, especially at the base, and connected with the posterior portion of the bullæ by prominent ridges. At the base of the paroccipital process, on the side looking towards the postglenoid, are seen two fossæ, separated from each other by a well-marked lamina of bone extending out from the paroccipital; in the anterior of these fossæ is found the point of articulation of the tympanohyal element of the hyoid arch, while in the posterior fossa is seen the external opening of the stylomastoid foramen.

At the posterior termination of the pterygoid plate of the sphenoid, and immediately in advance of the bulla, is situated the *foramen ovale*, while upon the outer side of the root of the pterygoid, in advance of, and a little internal to the foramen ovale, is seen another distinct, though smaller, foramen, which is in all probability the *foramen rotundum*. In front of this again come the large sphenoidal fissure and the optic foramen.

Oreodon gracilis *Leidy*.

This species, of which there are a number of skulls in our collection, has practically the same vertical distribution as *O. culbertsonii*. It is readily distinguished by its smaller size, by the

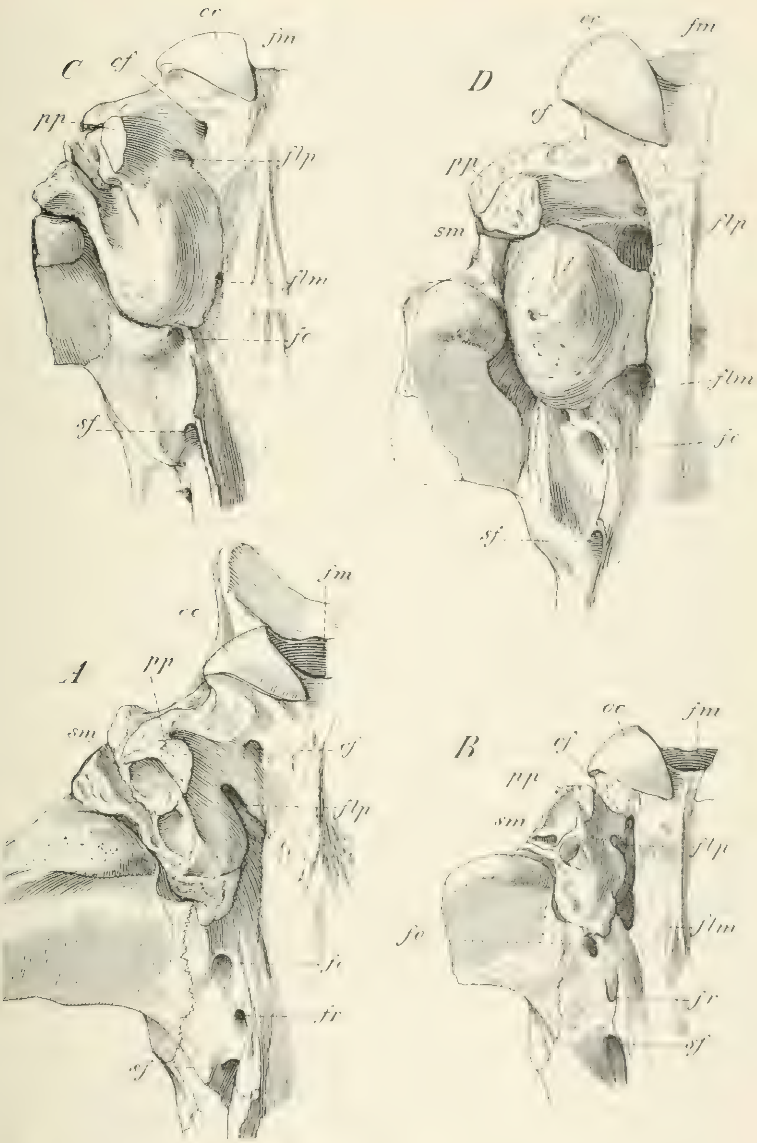
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Fig. 5. Evolution of the Basi-occipital Region in Oreodon. C, *Oreodon bullatus* (No. 611). D. *Eporeodon major* (No. 1038). A, *Oreodon culbertsonii* (No. 595). B, *Oreodon gracilis* (No. 596). Natural size.

somewhat greater inflation of the bullæ, and by the less distinct double fossa at the base of the paroccipital. It has, however, a distinct and relatively large foramen rotundum. Fig. 5 *B* (No. 596).

Oreodon bullatus *Leidy.*

There is a single skull of this species in our collection (No. 611) which was obtained from the second 'nodular layer,' from seventy-five to a hundred feet above the 'red layer' of the 'Oreodon Bed.' It is a matter of much interest to note that the bullæ are much more inflated than in either *O. culbertsonii* or *O. gracilis.* They are, moreover, extended backwards and are largely in contact with the paroccipitals, which are, however, not flattened from before backwards to any appreciable extent. The posterior fossa at the base of the paroccipital is but faintly represented, the anterior being large and distinct.

The *foramen rotundum* is represented by two very minute vestigial foraminæ at the sides of the pterygoid plate, between the sphenoidal fissure and the 'foramen ovale.' It is more than probable that these will be found wanting in many specimens of this species. In our specimen they certainly could not have been functional, and there can be little doubt that the superior maxillary nerve made its exit through the sphenoidal fissure. The foramen rotundum therefore may be said to be practically absent.

Eporeodon major (*Leidy*).

In the overlying Protoceras Beds Oreodons are very numerous. They are found principally in a nodular layer just as in the lower beds. So far as our collection shows, all the species of this upper horizon exhibit greatly inflated bullæ (see No. 1038); the paroccipital is flattened at its base and applied closely to the bullæ; there is no posterior fossa at the base of the paroccipital, and the foramen rotundum is entirely wanting. The crowns of the teeth are more elongated, and the species are slightly larger.

It is stated by Scott[1] upon the authority of Marsh,[2] that in the Oreodons from the John Day horizon the thumb is absent and that the bullæ are inflated. This character of the absence of the thumb is regarded by Scott as sufficient ground for the separation of these species into a distinct genus (*Eporeodon*). He does not apparently regard the species with the inflated bullæ from the White River formation as belonging to this genus, and criticises Marsh for proposing the genus upon the ground of the inflation of the bullæ. He remarks further that the forms with the large bullæ occur together with those of the uninflated bullæ in the same strata. This is not borne out by our observations. As regards the presence or absence of the thumb in the species from the Protoceras Beds very little is known at present, but it is a fact, abundantly demonstrated by our collection, that the greatly inflated bulla type, with flattened paroccipitals and lacking the foramen rotundum, comes *only from the upper or Protoceras Beds.* In a like manner those species in which the bullæ are little or not at all inflated, the paroccipitals are not flattened and the foramen rotundum is present, are confined to the lower part of the Oreodon Beds. The single example of the transitional form, *O. bullatus*, has a position exactly intermediate, in respect to its vertical distribution. These facts are significant, and seem to demonstrate very conclusively that the range in time corresponds with the evolution of the bullæ.

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[1] Morpholog. Jahrbuch, Vol. XVI, p. 330.

[2] 'Notice of New Tertiary Mammals,' Amer. Jour. Sci., Vol. IX, p. 230–250.

Family ANTHRACOTHERIIDÆ.

The expedition was fortunate in securing a number of specimens of *Hyopotamus*, including several more or less complete skulls and lower jaws, and of still greater interest the first remains of *Anthracotherium* found in this country, proving that the Anthracotheriidæ were represented by both the characteristic European genera.

Hyopotamus americanus *Leidy.*

This species, which has hitherto been known only from isolated teeth, is represented by the anterior portion of the skull (No. 575) and other remains. The molar teeth agree precisely with Leidy's type, and enable us to characterize this species more fully. It is of precisely the same size as the *H. velaunus* from Ronzon, as figured by Filhol. It also resembles this European species closely in the greater elongated, narrow muzzle, but differs from it in the absence of the first superior premolar. The skull, so far as preserved, does not present any further differences.

The locality is the 'Metamynodon stratum,' in which the remains of several individuals were found. Among them is a series of three upper molars (No. 576) which are of considerably larger size; also some lower jaws with milk teeth.

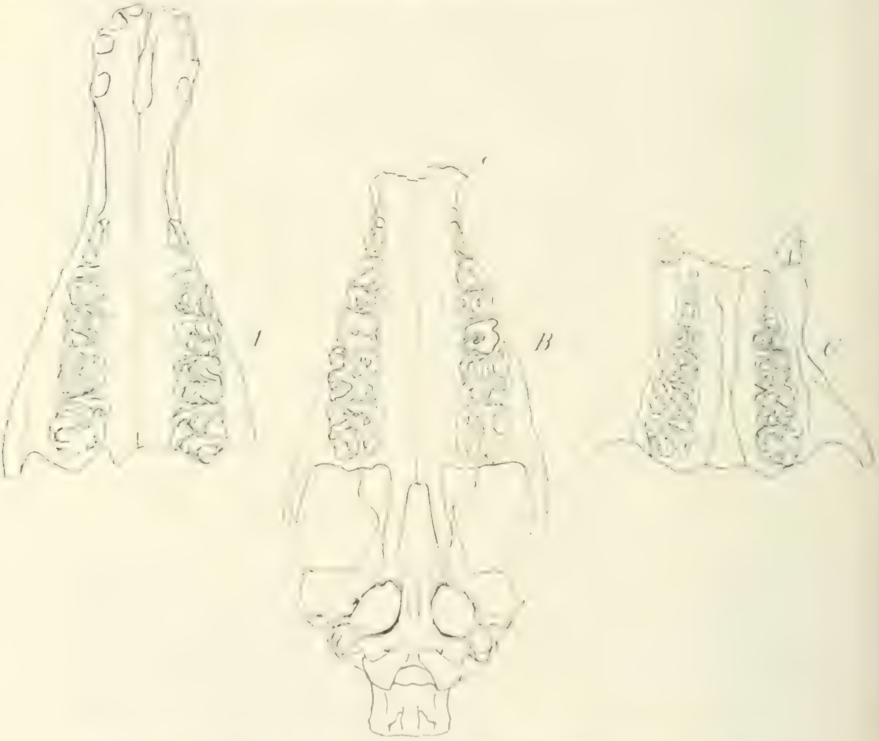

Fig. 6. Palatal Views of Skulls of Anthracotheres. A, *Hyopotamus americanus* Leidy (No. 575). B, *Hyopotamus brachyrhynchus*, type (No. 582). C, *Anthracotherium curtum*. One-fourth natural size.

Hyopotamus brachyrhynchus, sp. nov.

The type of this species is a skull (No. 582) from the overlying Protoceras Beds; it is well distinguished by the shortness of the muzzle, as the specific name indicates. The interval between the base of the canine and the second premolar is but one-half as great as in *H. americanus.* There is also a well-developed bifanged first premolar.

Metamynodon Beds.	Protoceras Beds.
H. americanus.	*H. brachyrhynchus.*
I.^{3}, C.^{1}, P.^{3}, M.^{3}. Muzzle elongated, C. to P.^{2} = 70 mm. Second upper premolar with feeble internal cingulum.	I.$^{-}$, C.^{1}, P.^{4}, M.^{3}. Muzzle short, C. to P.^{2} = 36 mm. Second upper premolar with strong internal cingulum. Molar cingula and styles strongly developed.

The type skull of *H. brachyrhynchus* is shorter than that referred to *H. americanus*, but otherwise is of the same proportions. The principal characters are as follows : Orbits open posteriorly ; a sagittal crest ; occiput compressed laterally, as in *H. aymardi ;* paroccipital process prominent and separated from the postglenoid by the tubular portion of the tympanic. The tympanic bullæ are well inflated as in the Peccary, but are lower, more rounded, and more elongated antero-posteriorly.

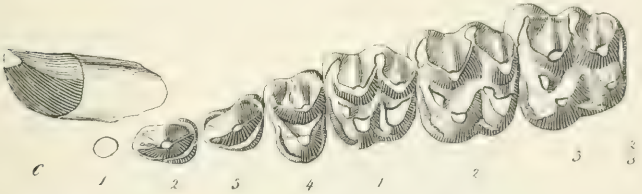

Fig. 7. Superior Dentition of *Anthracotherium ? curtum* Marsh.
Two-thirds natural size.

Anthracotherium curtum *Marsh.*

The specimen referred to this species is part of a skull (No. 1039) containing the canine, and the complete premolar-molar series of the left side, and the fourth premolar and three molars of the right side. In size it resembles the smaller European species. There is absolutely no diastema.

Upper dentition.—The canine is vertically placed and more triangular in form than in the European species, and exhibits a sharply worn anterior face. Pm. 1 is missing ; it is single-fanged. Pm. 2 has traces of the cingulum at the outer angles and upon the inner face. In Pm. 3 these features are strengthened, and this tooth exhibits a postero-internal shelf. Pm. 4 has a well-developed internal cusp (deuterocone) surrounded by a basal cingulum ; the protocone is subcrescentic. The molars exhibit rather low obtuse cusps of crescentic form, with the characteristic protoconule ; the parastyle and mesostyle are low and obtuse ; the metastyle is rudimentary or incipient except in M. 3 ; the internal cingulum is not very prominent. In general these teeth are of the low selenodont type found in the European forms.

The locality is the 'Metamynodon stratum' of the Oreodon Beds. The description of this specimen was completed when a communication was published by Professor Marsh[1] of a new species, *Heptacodon curtus*, founded upon a single molar tooth, and said to be "apparently allied to *Hyopotamus*." The type of *H. curtus* is slightly smaller than the specimen here described. The author does not recognize the relationship to *Anthracotherium*.

Anthracotherium karense, sp. nov.

This is a larger form from the Protoceras Beds, and is represented by the last two upper molars of the left side (No. 1040). It is well distinguished by the very strong development of the mesostyle upon M. 2 and M. 3, and by the prominent metastyle upon M. 3 The molars are of larger size than in *A. occidentale*, the cusps are more elevated and more sharply crescentic, the in-

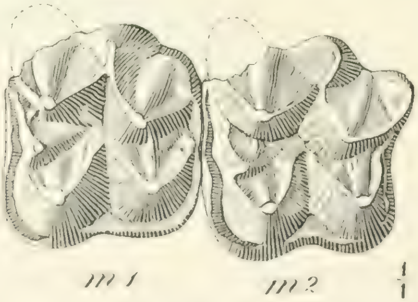

Fig. 8. First and Second Upper Molars of *Anthracotherium karense*, type Natural size.

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[1] 'A New Miocene Mammal,' Am. Jour. Sc., May, 1894, p. 409.

ternal cingulum is also much more prominent. In general these teeth approach more nearly the *Hyopotamus* type, excepting of course in the form of the mesostyle.

This species is named after one of the prominent peaks in the Black Hills—*Inyan Kara*.

METAMYNODON BEDS. *A. occidentale.*	PROTOCERAS BEDS. *A. karense.*
C.^{1}, P.^{4}, M.^{3}. Molars with low cusps semibunodont. Feeble metastyle on M.3. Internal cingulum not prominent. *Measurements :* M.2-3, 40 mm. Width M.3, 23 mm.	Formula unknown. Cusps of molars elevated and crescentic. Mesostyle a prominent crested spur. Metastyle very prominent in M.3. *Measurements :* M.2-3, 54 mm. Width, M. 3, 27 mm.

Order CREODONTA.

Family HYÆNODONTIDÆ.

Hyænodon paucidens, sp. nov.

This species is based upon an unusually perfect skull and lower jaw. The most striking characters in which it differs from all other Hyænodons hitherto discovered, is the absence of the first premolar in the upper jaw. The dental formula therefore is I. $\frac{3}{3}$ C.$\frac{1}{1}$, Pm.$\frac{3}{4}$, M.$\frac{2}{3}$, instead of I.$\frac{3}{3}$, C.$\frac{1}{1}$, Pm.$\frac{4}{4}$, M.$\frac{2}{3}$, as it is in all other species of this genus so far known. It has generally been the practice among palæontologists to regard a character of this importance as of generic value, and there are doubtless few who would hesitate to propose a new genus for its reception, but the skull in every other respect is so very like that of the other species of *Hyænodon* that it is deemed inadvisable to pursue such a course.

Careful examination shows that the absence of this tooth is not an accidental variation. In the first place the space which the first premolar should occupy is relatively shorter than in the nearest ally, *H. crucians*, being only 10 mm., whereas in *H. crucians* it is 15 mm. The entire length of the tooth line measuring from the posterior border of the upper canine to the posterior border of the last molar is 80 mm. in *H. crucians*, and 70 mm. in *H. paucidens.* The third premolars in both the upper and lower jaws have a more oblique position, and the teeth are more crowded than in *H. crucians.* The skull is slightly smaller, the muzzle narrower and the canines longer and more robust than in *H. crucians.* The palatal region agrees very closely with that of *H. crucians* in having the palatines in contact throughout their entire length, and the pterygoid plates of the alisphenoid separate in the median line. In this respect both species differ markedly from the species described by Scott,[1] *H. leptocephalus*, in which the pterygoid plates are in contact for a long distance. The interorbital constriction in the skull of *H. paucidens* is placed at the fronto-parietal suture, where the two diverging branches of the sagittal crest meet, as in the larger species *H. horridus* and *H. cruentus.* In *H. crucians* both are situated in advance of the interorbital constriction.

A synopsis of the American species of the genus may now be given as follows :[2]

I. *Superior Premolars 4.*
    A. Posterior nares opening between posterior part of palatines ; pterygoid plates of alisphenoid not in contact below.
        a. Cranial constriction in advance of fronto-parietal suture.......................................*H. crucians.*
        b. Cranial constriction at fronto-parietal suture.
            aa. Face very deep ; an external buttress on anterior lobe of last lower molar....*H. horridus.*
            bb. Face shallower ; buttress absent.......*H. cruentus.*
II. *Superior Premolars 3*.................................*H. paucidens.*
    B. Palatines in contact throughout ; pterygoid plates of alisphenoids meeting below................*H. leptocephalus.*

Hyænodon crucians *Leidy.*

A tolerably well-preserved skull of this species is represented in the collection, together with some few fragments of the skeleton. The skull is already well known, and does not call for any further mention. A fragment of the atlas shows that the transverse processes are pierced by the vertebral canal quite in the ordinary way. Two lumbar vertebræ exhibit the usual characters of the Creodonts in the complex mode of articulation of their zygapophyses. Their centra are strongly keeled below, and there are small though distinct anapophyses present. A fragment of the pelvis, including a part of the acetabulum and the ilium, is interesting as showing the relatively prominent tubercle for the origin of the *rectus femoris*, as well as the absence of the pubic spine. The ilium is apparently little expanded, and there is a distinct cotyloid notch. The proximal end of the femur shows a well rounded globular head, placed upon a constricted and rather elongated neck ; the head is marked by a distinct pit for the *ligamentum teres*. The digital fossa is of moderate size, and there is a small though distinct third trochanter. Only the shaft of the tibia is preserved, which indicates a moderately stout bone with considerable lateral compression and a prominent cnemial crest, as in the dog. A fragment of the shaft of the fibula shows that it was much reduced in size, and was slender and delicate. The calcaneum has a moderately elongated tuber ; a large facet for the fibula, a prominent external tubercle, and a very oblique facet for the cuboid.

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[1] Journal Acad. Nat. Sci. Philad., Ser. 2, Vol. IX, No. 2.

[2] See Scott, Journal Acad. Nat. Sci., Vol. IX, p. 175.

THE MILK DENTITION OF HYÆNODON.

A rather complete lower jaw of a young Hyænodon, pertaining to a small species (presumably *H. crucians*) contained in the collection, renders it possible to give a description of the milk dentition of the inferior series. Filhol has described[1] the inferior milk dentition of *Hyænodon cayluxi*, and considered the important fact of their supposed relationship with the Marsupials. Our specimen is more complete than Filhol's, and includes the canines and incisors in addition to the molars and premolars. The roots of two incisors upon the left side are preserved in position, which, together with an alveolus for the third tooth, enables me to state that there were three incisors upon each side. Just as in the permanent dentition, the second or median incisor is crowded back out of position ; their crowns are missing. The canines are small, much curved and sharp pointed, very much as they are in the dog. The root is compressed laterally, the enamel is extended down much lower upon the outside than upon the inside of the tooth, and there is a faint indication of a cingulum well up towards the point upon the inside.

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[1] 'Mammitères Fossiles des Phosphorites,' Paris, 1877.

As regards the milk molars, our specimen shows that the first tooth situated behind the canine did not develop a successor, and, as in the dog and so many other diphyodonts, is a *persistent milk tooth.* The second deciduous molar is missing, having already been shed ; a fragment of a root on the left side, however, indicates that it had been present. The third milk molar is still retained in position, and would have been, judging from the advanced state of eruption of the permanent tooth immediately beneath, the next one to be discarded. Its general form is like that of the corresponding permanent tooth destined to succeed it, with some few trifling exceptions ; it is, however, notably smaller and weaker in every way. The crown is made up of a principal cusp, to which is added in front a very weak and indistinct basal cusp, together with a somewhat stronger cusp and cingulum behind. The fourth deciduous molar is slightly larger than the preceding one. Its structure is very similar to the first permanent molar, which lies immediately behind it, with which it also agrees very well in size. The crown consists of three cusps, the two anterior of which form a rather imperfect though distinct pair of sectorial beads ; the third cusp is basal and makes up the weak heel or talon. Its structure is more complex than that of its permanent successor, as is so universally the case among the Carnivora.

It is proper to speak in this connection of the peculiar character of the first lower true molar of the Hyænodonts in general, since our specimen seems to throw some light upon this question. If the adult, permanent dentition of any of either the European or American species of *Hyænodon* be examined, *the small weak first lower molar* is a very noticeable and constant feature. The great disparity in size between it and the tooth immediately in advance, as well as the one immediately behind it, is very marked. It is, moreover, always much more worn, lighter in color, and has all the characteristic marks of a persistent milk tooth. I am now able to state from the condition of wear that *it was protruded early with the milk set*, and not after the lapse of a considerable period, as is always the case among other diphyodonts. If therefore we are to judge of it by its size, date of appearance, as well as its general structure, it will be necessary to classify it with the first series in the time of its eruption.[1] If this be true it points to a condition among the ancestors of the Creodonts wherein there were five instead of four teeth protruded together.

This peculiarity of the first lower molar is not confined to *Hyænodon*, but is also seen in *Pterodon* and many species of *Stypolophus* as well, although perhaps not so distinctly. It is perhaps another fact suggesting the lineal descent of *Hyænodon* from *Stypolophus*.

Order CARNIVORA.

Family NIMRAVIDÆ.

Genus **Hoplophoneus** *Cope.*

This type is represented by two species, the smaller of which, *H. primævus*, is the most abundantly represented. Both species appear to be confined to the 'Oreodon Beds.' Although fragmentary feline remains were also found in the upper 'Protoceras Beds,' they cannot be identified with certainty, and it is probable that they do not pertain to the *Hoplophoneus* type, insamuch as they indicate an animal of much larger proportions.

Hoplophoneus occidentalis *Leidy.*

This species is represented in the collection by two individuals, in one of which the skull and nearly all the vertebræ are preserved, and in the other the limbs and vertebræ in excellent condition, thus rendering it possible to give a complete restoration of the animal.

The chief distinction between the two known White River species is found in the superior premolar formula. In *H. primævus* there are three premolars above, whereas in *H. occidentalis* there are only two. There is another very constant and important difference between the two species in the matter of size. A comparative statement of the measurements of some of the more important bones brings this fact out very clearly.

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[1] See Wortman, 'American System of Dentistry,' p. 500.

	H. occidentalis.	*H. primævus.*
Length of Humerus	200 mm.	170 mm.
" Ulna	212	163
" Radius	160	132
" Femur	250	195
" Tibia	188	160
" Sacrum	100	73

In the numerous specimens of both species in our collection, the astragalus shows a remarkably flat trochlea, as in the Creodonts, and the astragalar foramen is present and well developed. In the carpus the scaphoid, lunar and centrale are united, but the suture between the two first-mentioned bones is always visible even in old individuals.

EXPLANATION OF PLATE II.

The Lower Miocene Rhinoceroses.

Evolution of the Skull.

Figures one-eighth natural size.

E. Aceratherium platycephalum.

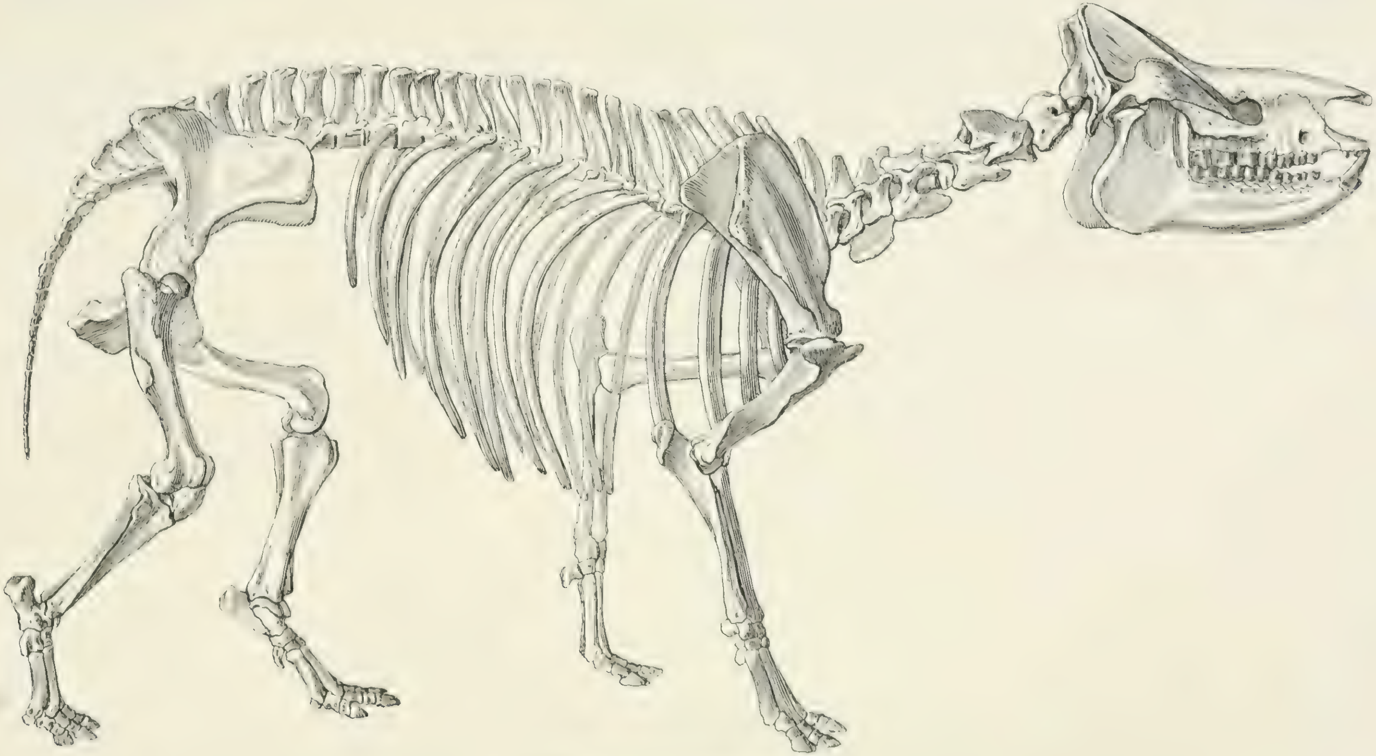
D. Aceratherium tridactylum.

C. Aceratherium occidentale.

B. Aceratherium mite.

A. Aceratherium trigonodum.

H. Hyrachyus agrarius (from the Middle Eocene, Bridger Formation).



ACERATHERIUM TRIDACTYLUM.

One-tenth natural size

Article VIII.—ON THE AFFINITIES OF LEPTARCTUS PRIMUS OF LEIDY.

By J. L. Wortman.

Up to the present time but very little has been known of the existence of the peculiarly American family Procyonidæ in any deposits older than the very latest Quartenary. Leidy has described and figured[1] an isolated last upper tooth, from the Loup Fork deposits of Nebraska, under the name of *Leptarctus primus*, which has been referred to this family. The Museum Expedition of last year into this region was successful in obtaining additional material, which we provisionally refer to Leidy's species.

Leptarctus primus *Leidy*.

The specimen consists of the right ramus of the lower jaw, carrying the third and fourth premolars and the canine. The condyle is broken away, but the coronoid process and the angle are preserved. The specimen is from a young individual in which the last premolar had just cut the gum. The alveoli of all the other teeth are present and in a good state of preservation.

The dental formula is as follows : I. $\frac{}{3}$, C. $\frac{}{1}$, Pm. $\frac{}{3}$, M. $\frac{}{2}$. The incisors are not preserved, but their alveoli indicate that they were much crowded, the outside one being placed almost directly in front of the canine, and the middle one pushed back considerably out of position. This series is in marked contrast with that of the Raccoon, in which the crowns of the incisors form almost a straight line across the jaw, and the middle one is crowded backwards to a very slight extent. The canine is peculiar and differs markedly from that of the Raccoon. It is rather robust, very much recurved and grooved by a deep vertical sulcus upon its antero-internal face. This sulcus is but faintly indicated in the Raccoon. The postero-external face of the crown is marked by a sharp ridge which becomes more prominent near the apex. The first premolar is not preserved, but its alveolus indicates that it was a single-rooted tooth, placed behind the canine after the intervention of a very short diastema. The second premolar is bifanged ; its crown is composed of a principal cusp, to which is added behind a small though very distinct second cusp. There is in addition to these cusps a distinct basal cingulum, most prominent in the region of the heel. The third premolar, like the second, is double rooted ; its crown moreover is made up of two cusps, the posterior being almost as large as the principal one. These cusps do not stand in the line of the long axis of the jaw, but are placed very obliquely to it. The heel is not very prominent, but the basal cingulum is well developed, both in front and behind. As compared with the Raccoon, the second premolar is more complex in that it has two cusps instead of one. In the third premolar the posterior cusp is much better developed, and placed more obliquely than in the corresponding tooth of *Procyon* ; the heel is moreover not so broad.

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[1] Extinct Fauna of Dakota.

The first molar is not preserved, but judging from the size of its roots it was decidedly the longest tooth of the series. The second molar was likewise bifanged but much smaller ; it was placed close against the base of the coronoid.

The whole jaw has, relatively, a greater depth than that of the Raccoon, and is remarkably straight upon its lower border, whereas in the recent genus it is considerably curved. The condyle is not preserved, and the angle is somewhat damaged, but it was apparently not so strongly inflected as in the Raccoon. The masseteric fossa is deep and prominent, and the coronoid is high and broad. The inferior dental canal is placed higher than it is in the Raccoon, being slightly above the tooth line. The symphysis is relatively deeper and more robust than in *Procyon*, and the chin is heavier and more abruptly rounded.

The jaw of *Leptarctus* differs from that of *Cercoleptes* in the following characters : the coronoid is broader and of less vertical extent ; the condyle is not placed so high ; the angle is elevated above the lower border of the ramus, which is straight and not concave as it is in *Cercoleptes*. In the depth of the symphysis and abrupt rounding of the chin the two genera are similar. *Cercoleptes*, moreover, has a moderately deep groove upon the antero-internal face of the canine, but differs from that of *Leptarctus* in having an external groove as well. *Cercoleptes* again resembles *Leptarctus* in having only three premolars in the lower jaw ; the middle one, however, has only a single cusp upon the crown, whereas *Leptarctus* has two.

As compared with *Bassaricyon*,[1] the jaw is more robust, shorter and deeper, with a more prominent chin. The two genera differ again in the number of premolars.

Altogether, *Leptarctus* appears to offer a number of transitional characters between the more typical Procyonidæ and the aberrant *Cercoleptes*. This is especially to be seen in the proportions of the jaw, the reduction of the number of premolars, the reduction in size of the last molar, as well as the depth of the mandibular symphysis.

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[1] See J. A. Allen's paper, Proc. Phil. Acad., 1876, p. 21.

Article IX.—CRANIAL VARIATIONS IN NEOTOMA MICROPUS DUE TO GROWTH AND INDIVIDUAL DIFFERENTIATION.

By J. A. Allen.

Plate IV.

In view of the stress naturally, and very properly, laid upon the importance of cranial characters in the discrimination of species in groups of closely-allied forms, it seems desirable to ascertain the character and amount of change in not only the general form of the skull but in the form of its separate bones due to growth, and also to determine the amount and kind of individual variation that may be expected to occur in skulls unquestionably of the same species. Having of late had occasion to examine a large amount of material relating to the genus *Neotoma*, the subject has been forcibly brought to my attention, and some of the results of a careful examination of a large series of skulls pertaining to several species of this genus are here presented. No attempt is made to treat the subject exhaustively, only a few special points being here presented.

As is well known to all experienced workers in mammalogy, the general contour of the brain-case, the relative size and form of individual bones, notably the interparietal, and the condition of the supraorbital and other ridges for muscular attachment, alter materially after the animal reaches sexual maturity; the deposition of osseus matter, the closing of sutures, the building out of crests and rugosities continuing throughout life, so that a skull of a very old animal may differ notably from that of an individual of the same species in middle life, and this latter from one just reaching sexual maturity.

The Museum has at present a large series of specimens of *Neotoma micropus* Baird, including ages ranging from nursling young to very old adults. They are mainly from three localities in the eastern coast district of Texas, namely, Brownsville, Corpus Christi, and Rockport. In order to avoid any complications that might arise through geographic variation, only the specimens from Rockport and Corpus Christi—localities less than twenty-five miles apart, and similar in physical conditions—are here considered. There is not the slightest reason for questioning their conspecific relationship. The series selected to illustrate variations due to age are, with one exception, from Rockport; those figured to show individual variation are all from Corpus Christi.

Variations due to Age.

General Contour.—The variation in the general form of the skull resulting from growth is due mainly to the lengthening of the several skull segments without a corresponding relative increase in the breadth of the skull. Hence in the young skull, in comparison with an adult skull of the same species, the brain-case is disproportionately large in comparison with the anteorbital and basal portions of the skull. This is well shown in Plate IV, and in the subjoined table of measurements of three

Measurements and Ratios showing Cranial Variations due to Age in *Neotoma micropus.*

	No. 5834, ♀ juv.	Ratio[1]	No. 4480, ♂ juv.	Ratio[1]	No. 4478, ♂ very old.	Ratio[1]
Occipito-nasal length	31	100	41	100	53	100
Length of nasals	10	32.3	14.5	35.4	22	41.5
Length of frontals	13	42	15	36.6	18	34
Length of parietals on median line	5	19.4	6	14.6	8	15
Greatest length of parietals	12	39	15	36.6	16	30.2
Length of interparietal	4.5	14.5	5.5	13.4	7	13.2
Length of brain-case	14	45.2	17	41.5	21	39.6
Greatest rostral breadth	5.5	17.7	6.3	15.4	6.5	12.3
Least interorbital breadth	6	19.4	6	14.6	6	11.3
Breadth of brain-case	16	51.6	19.5	45	20	38
Breadth of interparietal	11	35.5	10	24.4	7.5	14.2
Greatest zygomatic breadth	20?	64.6	23	56.1	30	56.6
Depth of skull at middle of palate	8	26	11	26.8	15	28.5
Depth of skull at front of basisphenoid	11	35.5	12	29.3	14	26.4
Length of tooth-row (crown surface)	8[2]	25.8	8	19.5	9	17
Length of incisive foramina	6	19.3	8.5	20.7	11.5	21.7
Width of incisive foramina	3	9.7	3	7.3	3.5	6.6
Length of palatal floor	5	16.1	7	17	7	13.2

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[1] Ratio to occipito-nasal length.

[2] From No. 4482, ♀ juv., in which the last molar has just come into use.

specimens of *N. micropus* from Rockport, Texas. No. 5834, ♀ juv., is a nursling so young that the last molar is still wholly enclosed in the jaw;[1] No. 4480, ♂ juv., though not quite full-grown, would pass as a 'young adult'; No. 4478, ♂ ad., is a very old male, with the teeth well worn down, and the fangs visible at the alveolar border. Other specimens in the series furnish a complete series of gradations between the two extremes (Nos. 5834 and 4478).

In general contour (Figs. 1–11, Pl. IV), the young skull, in comparison with adults, is much more convex in dorsal outline,[2] very broad posteriorly, and very narrow anteriorly. In comparing the relative length of the several skull segments the occipito-nasal length is taken as the basis, and the skulls will be referred to as *A* (=No. 5834), *B* (=No. 4480), and *C* (=No. 4478).

Rostral Segment.—In *A* the ratio of the rostral segment to the total length is 32.3 per cent.; in *B*, 35.4; in *C*, 41.5—giving a rapid *increase* in the ratio with age.

Frontal Segment.—In *A* the ratio of the frontal segment—*i. e.*, the distance between the naso-frontal and fronto-parietal sutures—to the total length is 42 per cent.; in *B*, 36.6; in *C*, 34—a considerable *decrease* in the ratio with age.

Parietal Segment.—In *A* the ratio of the parietal segment—*i. e.*, the distance from the latero-anterior angle of the parietal bone on either side to the occipito-parietal suture—to the total length is 39 per cent.; in *B*, 36.6; in *C*, 30.2—again a rapid decrease in the ratio.

Brain-case.—The length of the brain-case in *A* is 51.6 per cent. of the total length of the skull; in *B*, 45; in *C*, 38.

In each case the change in ratio is due to the disproportionate growth of the rostral portion of the skull. Thus in *A* the nasals have a length of only 10 mm.; in *B* they have increased to 14.5 mm., and in *C* to 22 mm., while the total occipito-nasal length of the skull has increased only from 31 mm. in *A* to 53 mm. in *C*. In other words, the nasal bones have increased in length 120 per cent., while the total length has increased only 77 per cent.

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[1] The length of the tooth-row given in the table is taken from an older specimen (No. 4482, ♀ juv.), in which the last molar has reached the level of the others and is just beginning to show traces of wear.

[2] In Figs. 10 and 11 it should be noted that the greater flatness of the skull interorbitally, as compared with Fig. 6, is masked by the raised supraorbital borders in the older skulls when viewed in profile.

Transverse Breadth.—In respect to the breadth of the skull the variations with growth are much less than in its length. Thus the greatest diameter of the rostrum varies only from 5.5 mm. in *A* to 6.5 in *C*—an increase of about 20 per cent. in the breadth of the rostrum, against an increase of 120 per cent. in its length. The interorbital breadth remains nearly constant, being 6 mm. in all three of the skulls here compared. The width of the brain-case shows an increase of 25 per cent. against an increase in the total length of the skull of 77 per cent. The zygomatic breadth shows an increase of about 50 per cent., due almost wholly to the thickening and increased convexity of the zygomatic arches.

Vertical Depth.—In respect to the depth of the skull, the variations with age prove especially interesting, although only such as would be expected from the facts already given. For present purposes the depth of the skull is taken at two points, namely, (*a*) at the middle of the palatal region, and (*b*) at the posterior border of the basisphenoid (basisphenoid-basioccipital suture). The palatal depth increases markedly with age, correlatively with the growth of the rostrum ; the basisphenoidal depth changes but slightly after the molars have attained to functional development. Thus in *A* the basisphenoidal depth is 11 mm. ; in *B*, 12 mm. ; in *C*, 14 mm.—an increase of about 28 per cent. The palatal depth in *A* is 8 mm. ; in *B*, 11 mm. ; in *C*, 15 mm.—an increase of nearly 88 per cent.

Tooth-row.—The length of the upper tooth-row varies about 12 per cent., due almost wholly to the wearing down of the teeth, the length of the crown surface being much less, in slightly worn teeth, than the length taken at the alveolar border.

Interparietal.—The interparietal shows surprising modification with age, both as to size and form, but especially in respect to the latter. At early stages, as in *A*, this bone is more or less crescentic in shape, with the transverse diameter more than twice the antero-posterior diameter. Thus in *A* the two diameters are respectively 11 and 4.5 mm.; in *B*, 10 and 5.5 mm.; in *C*, 7.5 and 7 mm. In other words, the short, broad, convex sub-crescentic interparietal in *A* becomes transformed in *C* into a squarish, flat bone in which the two diameters are nearly equal, instead of the transverse being twice as great as the antero-posterior, as in *A*. This would be almost incredible were not the proof so abundantly furnished by the material in hand, where every stage of transition is shown. (Figs. 1–8, Pl. IV.) This change is coincident with the development of the raised supraorbital borders and their prolongation backward as ridges to the parieto-occipital suture, and the flattening of the whole dorsal aspect of the post-rostral portion of the skull. In old age these ridges become confluent with the lateral edges of the interparietal which has now lost its postero-lateral moieties, partly apparently by absorption and partly by their being overgrown by the mediad posterior angle of the parietals. A sharp thin ridge for muscular attachment also extends back from the posterior base of the zygomatic arch. The interparietal at the same time develops a more or less prominent median angular projection at its posterior border, confluent with the median ridge of the supraoccipital. The contrast between these conditions, obtaining only in very old skulls, and their almost entire absence in skulls which have just reached sexual maturity, is strikingly great.

Supraoccipital.—The supraoccipital changes from a posteriorly convex, thin lamina of bone, in early life, to a thick, nearly vertical plate, with a strongly-developed median ridge produced into an angular spine at its superior border, and with a lateral ridge on either side about midway between the median line and its lateral borders; these lateral ridges also each develop an angular rugosity or process about midway their length. The superior border is also produced into an incipient occipital crest.

Basioccipital.—The basioccipital becomes greatly altered by growth, as in fact is the case with the whole postpalatal region. In comparing stages *A* and *C* it is found that the distance across the occipital condyles increases only about 15 per cent., while the breadth of the anterior border increases 100 per cent., and the length about 50 per cent. (Figs. 12-14, Pl. IV.)

Basisphenoid.—The basisphenoid doubles in length, and its anterior third becomes differentiated into a narrow projecting neck. The presphenoid at stage *A* is nearly hidden by the palatal floor. (Figs. 12-14, Pl. IV.)

Postpalatal Region as a whole.—This doubles its length with an increase in breadth of only about 50 per cent. At stage *A* the postpalatal border terminates slightly behind the posterior edge of M.2 ; in stage 3 it holds very nearly the same position. The distance between the postpalatal border and the front border of the auditory bullæ, compared with the total length of the skull, is as 1 to 9 in *A*, and as 1 to 5 in *C*. In *A* the pterygoid hamuli reach the second fourth of the bullæ ; in *C* they terminate slightly in advance of the bullæ. The bullæ themselves in *A* are more obliquely placed than in *C*, in relation to the axis of the skull, and are quite differently shaped. Also the form of the foramen magnum has undergone much change. These points are all well shown in Figs. 12-14 of the accompanying plate.

Incisive Foramina.—Consequent upon the growth of the rostral portion of the skull, the incisive foramina undergo marked change in form, and somewhat in position, as regards both their anterior and posterior borders. In the stage designated as *A* they are short and broad, and extend relatively further both anteriorly and posteriorly than in stage *B* or *C*, their anterior border being nearer the base of the incisors, and their posterior border being carried back to or slightly behind the front border of the first molar. Thus in *A* the length of the incisive foramina is 6 mm., with a maximum breadth of 3 mm., while in *C* the dimensions are respectively 11.5 and 3.5 mm.—a great increase in length with only slight increase in breadth. At the same time the anterior border is considerably further from the base of the incisors, and the posterior border is slightly in advance, instead of slightly behind, the front border of the molars.

Spheno-palatine Vacuities.—In adults of *Neotoma micropus*, as in other species of the 'round-tailed' section of the genus, there is a long, broad vacuity on each side of the presphenoid and anterior third of the basisphenoid, which Dr. Merriam has recently named[1] the '*spheno-palatine vacuities*,' and he has also called attention to the fact that they are not present in some forms of the 'bushy-tailed' section of the genus. It is therefore of interest in the present connection to note that these vacuities are absent at stage *A*, and are only partially developed at later stages (Figs. 12-14, Pl. IV). My attention was called to the matter by finding several nearly fully-grown skulls from Texas and northeastern Mexico with these vacuities either quite absent or represented by an exceedingly narrow slit, while I could find no differences in the skins or in other cranial characters that gave the slightest hint that the animals were not referable to *N. micropus*. Further examination of young skulls of undoubted *N. micropus* from Rockport and Corpus Christi, Texas, showed that the closed condition was in this species a feature of juvenility. It is thus of interest to find that a feature which proves to be merely a character of immaturity (and quite inconstant as well) in *N. micropus* is a permanent condition in *N. cinerea occidentalis*.[2]

In the development of these vacuities it appears that as the presphenoid increases in length it becomes reduced in width; at the same time, as the skull broadens, the edges of the ascending wings of the palatine bones become slightly incised. There is, however, much individual variation in this respect, as will be shown later.

Molars.—When the molars first cut the gum they have nearly the entire crown-surface capped with enamel. Very soon, even before the tooth has attained its full height, the enamel begins to disappear from the centers of the enamel loops, the capping remaining longer over the narrower loops than over the broader ones; it quickly disappears from all as soon as the crown-surface becomes subject to wear. In stage *A*, in which only M.1 and M.2 have appeared, and are less than one-third grown, the enamel walls of the loops nearly meet over the dentinal areas—quite meeting over the narrower portions, especially in the case of the middle transverse loop of each tooth. Some time before the age represented by *B* is reached, the crown-surface is worn to an even plane; the tooth has reached its normal length, but the fluting of the sides still extends to the alveolar border. As attrition goes on, with the advance of the animal in age, the crown-surface wears down, and the neck of the tooth appears above the alveolar border, till, especially in the upper molars, the fluted terminal and the smooth basal portions are of nearly equal extent; but in old age (as in *C*) the smooth basal portion is the longer and the division of the root into fangs is clearly shown. With this wearing down the tooth increases somewhat in both width and length, but the pattern of the enamel folds undergoes but slight change until nearly the whole crown is worn away, except that the angles become gradually more rounded.

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[1] Proc. Biol. Soc. Wash., VIII, p. 112, July, 1893.

[2] Unfortunately the outline figures here given (Figs. 12-15, Pl. IV,) fail to show clearly the points at issue.

Résumé.—As already stated the change with age in the general form of the skull is due to the relatively disproportionate increase in length of the pre- over the post-orbital region, and the same disproportionate increase of the basal region as compared with the frontoparietal elements. In the first case the rostrum becomes relatively greatly produced; in the second the basioccipital and adjoining parts become so greatly enlarged as to change the entire aspect of the basal region of the skull. Thus the occipital condyles, which in *A* terminate slightly in advance of the most convex portion of the supraoccipital, and are crowded up very close to the bullæ, form in *C* the most posterior part of the skull, with a considerable interval between them and the bullæ. (Figs. 12–14, Pl. IV.)

INDIVIDUAL VARIATION.

In comparing a large series of skulls of the same species it quickly becomes apparent that no element of even the adult skull is constant, either as to form or relative size. There is also much variation in the size of skulls of the same sex and approximately the same age.

Variation in Size.—Thus in *Neotoma micropus*, from the same locality, there are dwarfs and giants. While the females average smaller than the males, size is by no means a safe criterion of sex. Thus two old females, not appreciably different in age, from Corpus Christi, Texas, vary as follows: No. 2948, total length 51 mm., zygomatic breadth 26 mm.; the corresponding dimensions in No. 2955 are 45 mm. and 24 mm. These are merely the extremes of a series of six specimens; with a much larger series doubtless the difference would be considerably increased. A series of six old males, from the same locality and indistinguishable as to age, vary as follows: No. 2952, total length 50.5 mm., zygomatic breadth 27 mm.; the corresponding dimensions in No. 2956 are 45 mm. and 25 mm.

Nasals and ascending branches of the Premaxillæ.—Ordinarily in *N. micropus* the nasals terminate in a gradually narrowed evenly rounded point, a little less than 2 mm. in front of the posterior termination of the ascending branches of the premaxillæ. The distance between the points of termination of the nasals and premaxillæ, however, frequently varies between 1.5 and 2.5 mm.; more rarely from 1 to 3 mm. These extremes each occur in the ratio of about 10 per cent. of the whole, while probably 60 per cent. would not vary much from the normal average of about 2 mm. (See Figs. 1–8 and 16, 17, Pl. IV.)

The nasals, as already said, usually terminate in an evenly rounded point, but in several of the 50 skulls of *N. micropus* before me their posterior border forms a double point, *each* nasal terminating in a distinctly rounded point; in one or two the posterior border is squarely truncate; in others it is irregularly uneven. The ascending branches of the premaxillæ usually terminate in an obtusely V-shaped point, with a uniformly even outline, their breadth, however, being subject to variation; in some specimens they terminate in a brush of irregular spiculæ. (Figs. 1–8 and 16, 17, Pl. IV.)

Frontals.—The posterior border of the frontals is subject to great irregularity, varying from a nearly transverse line (rounded slightly at the outer corners) to a gentle, rather even convexity, and thence to an acute angle, involving the whole posterior border. It is difficult to decide what outline is the most frequent, though the tendency seems to be greatest toward a well-pronounced rather even convexity. Figures 1–8 and 18, 19, Plate V, well show the variation in the position and direction of the fronto-parietal suture.

Parietals.—The anterior outline of the parietals of course conforms to the posterior outline of the frontals, and must be equally variable. It hence follows that their length on the median line is also variable. Their posterior border is also subject to much variation in consequence of the great diversity in the form of the interparietal.

Interparietal.—In middle-aged specimens the interparietal tends strongly to a quadrate form, varying from quadrate to diamond shape, through a more or less marked median angular extension of both its anterior and posterior borders, and occasionally of its lateral borders as well. Often it forms a quadrate figure, in which each of its four sides is slightly convex ; again the corners are so much rounded, and the lateral breadth so much in excess of the antero-posterior, as to give a lozenge-shaped figure. In other cases it is distinctly shield-shaped ; in others it is hexagonal. In size the variation is fully 50 per cent. of what may be regarded as the average dimensions. These remarks have strict reference to fully adult specimens, and as nearly as can be judged these variations are not at all due to differences of age, which, as already shown, has so great an influence upon the size and form of this exceedingly variable element of the skull.[1] (Figs. 20–23, Pl. IV. Compare also the interparietal, as shown in Figs. 1–8.)

Ventral aspect.—The ventral aspect of the skull presents numerous points of variability, only a few of which will be here mentioned. The palate varies more or less in breadth, and especially in the development of the anterior palatal spine, which is sometimes slight, and sometimes so strongly produced anteriorly as to touch the vomer. The postpalatal border may be evenly concave, or present a slight median process. The presphenoid is very variable in size, being often an exceedingly slender rod of bone, and at other times very stout, the variation in thickness being nearly or quite 100 per cent. The anterior third of the basisphenoid shares in the same variability. As the ascending borders of the palatals are also variable in respect to the extent of their development, it follows that there is, even among adults, a wide range of variation in the size of the spheno-palatine vacuities.

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[1] As regards variation with age in the form of the interparietal, *Neotoma micropus* is only an example of what doubtless prevails throughout the genus, and even in many other genera as well. Yet in adult animals the form of this bone seems, as a rule, to be sufficiently constant to be of more or less taxonomic value. Thus in the *N. cinerea* group it may be said to be normally quadrate ; in the *N. fuscipes* group it is quite constantly shield-shaped. In *N. floridana*, however, and in the *N. mexicana* group, it seems to be nearly or quite as variable as in *N. micropus*, both as to size and shape.

Teeth.—Aside from differences due to age and attrition, the teeth vary in size to a considerable extent among individuals strictly comparable as to sex and age, some having a much heavier dental armature than others. But more particularly noteworthy in this connection is the variation in the color of the teeth, which seems strongly a matter of individuality. Although Dr. Merriam has recently placed *N. micropus* in his "*Neotoma leucodon* group,"[1] which has, among other alleged characters, "color of teeth white or nearly white," the teeth in *N. micropus* average blacker than in any other species of the genus known to me. Were this all it might be considered that *N. micropus* was erroneously referred to the '*leucodon* group'; but unfortunately the range of individual variation in the color of the teeth in the large series at hand covers also the whole range of variation for the genus. Thus in some instances the molar teeth are intensely black from base to crown, while the crown-surface itself is strongly blackish, even the enamel loops, as well as the enclosed dentine being tinged with blackish; in other cases the teeth are merely slightly tinged with brownish near the base and at the bottom of the sulci. These extremes are connected by a series of very gradual intergradations. In other words, among hundreds of skulls of *Neotoma*, those with the blackest teeth occur in *N. micropus*, as well as those in which the teeth are practically white.

In the suckling young the teeth are pure white; before M.3 has come to wear, M.1 and M.2 have become more or less blackened; in young adults, and in middle aged specimens, the teeth are often intensely black; in old specimens, with the teeth much worn, the teeth average lighter than in the younger individuals. There is, however, a wide range of variation in the color of the teeth in specimens of corresponding age, whether old or young. The black coloring consists to a large extent of a superficial incrustation which tends to scale off in flakes in the prepared skull, and its absence apparently may be due sometimes to removal in the process of cleaning the skull for the cabinet. In other words, the blackness is to some extent an accidental or pathological condition, due probably more or less to the particular character of the food or to the health of the animal.

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[1] Proc. Biol. Soc. Wash., IX, p. 118, July 2, 1894.

General Remarks.

The bearing of what has been stated above respecting variations in the form of the skull and of its principal elements due to age is of course obvious, the inference being that in animals which have reached sexual maturity variations due wholly to growth, in passing through adolescence to senility, may readily be mistaken, when working with very small series or with single specimens, for differences of subspecific or even specific importance. Not only do the individual bones vary in their outlines and proportions and in relative size, but the skull varies as a whole in its relative dimensions, including depth as well as length and breadth. There is beside this a wide range of purely individual variation, affecting every character that can be used in a diagnostic sense. Thus in a series of fifty skulls of *Neotoma micropus* it would be easy to select extremes, of even individual variation, that depart so widely from the average, in one or more characters, as to deceive even an expert, on considering these alone, into the belief that they must represent very distinct species ; yet in the present instance the proof that such is not the case is overwhelming. In *N. micropus* the coloration is remarkably constant, for a member of this genus, at all seasons and ages, so that the case is less complicated than it would be in many other species of the group, where the color of the pelage varies radically with season and age.

Personal criticism is not the purpose of the present paper, and it was not my intention at the outset to refer specifically to the work of any of my *confrères.* Since its preparation was begun, however, its *raison d'être* has perhaps been emphasized by the publication of two brochures of 'preliminary descriptions' of species and subspecies of the genus *Neotoma*, numbering altogether 10 species and 8 subspecies, which added to the 22 species and subspecies previously standing practically unchallenged, makes, at the present writing, a total of 40 forms of the genus *Neotoma*. Of these no less than 26 have been described within the last nine months.[1] Without the material before me used by the original describers of these forms it would be presumptive to give an opinion respecting the merits of many of them. While the greater part may have some real basis, it is evident that others are almost unquestionably synonyms of previously-described forms, judging by 'topotypes' in this Museum, the brief diagnoses accompanying the names affording in these cases no characters that are in the least degree distinctive.

The genus *Neotoma* was chosen for treatment in this connection in preference to some other almost solely by chance, as the facts of variation above presented are not at all exceptional. In fact the common muskrat (*Fiber zibethicus*) would have shown a still more striking case of variability, as would also various species of many other genera. Yet describers of new species are constantly laying stress upon cranial differences that have not necessarily the slightest specific or even subspecific importance; and, so far as can be judged from their descriptions, they are entirely unconscious that such can be the case.

On the other hand, it is equally certain that such alleged characters may have the value assigned them; since it is now a well known fact that the extremes of purely individual variation in any character, external or internal, may exceed in amount the average differences that serve to satisfactorily distinguish not only well-marked subspecies, but even forms that are unquestionably specifically distinct. Hence it must often happen that the determination of the status of a species or subspecies originally described from one or two specimens, in groups especially susceptible to variation, must depend upon the subsequent examination of a large amount of material bearing upon this and its closely-related forms.

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[1] For a list of the species and subspecies of *Neotoma* described prior to July 6, 1894, see Abstr. Proc. Linn. Soc. New York, No. 6, pp. 34, 35, July, 1894.

EXPLANATION OF PLATE IV.

Figures all Natural size.

Neotoma micropus *Baird.* Showing cranial variations due to age and individualism. (Unless otherwise stated, the specimens are from Rockport, Texas.)

Figs. 1–8. Dorsal aspect of skull, showing gradual change in form with age, and especially in the form and relative size of the interparietal. Fig. 1, No. 5834, ♀ juv. (suckling). Fig. 2, No. 2975, ♀ juv. (nearly sexually adult), Corpus Christi, Texas. Fig. 3, No. 5841, ♀ ad. Fig. 4, No. 4480, ♂ ad. Fig. 5, No. 2958, ♂ ad., Corpus Christi. Fig. 6, No. 4479, ♂ ad. Fig. 7, No. 4477, ♀ ad. Fig. 8, No. 4478, ♂ ad.

Figs. 9–11. Skull in profile, to show change of form with growth. Fig. 9, No. 5834, ♀ juv. (nursling). Fig. 10, No. 4480, ♂ ad. (rather young). Fig. 11, No. 4478, ♂ ad. (very old).

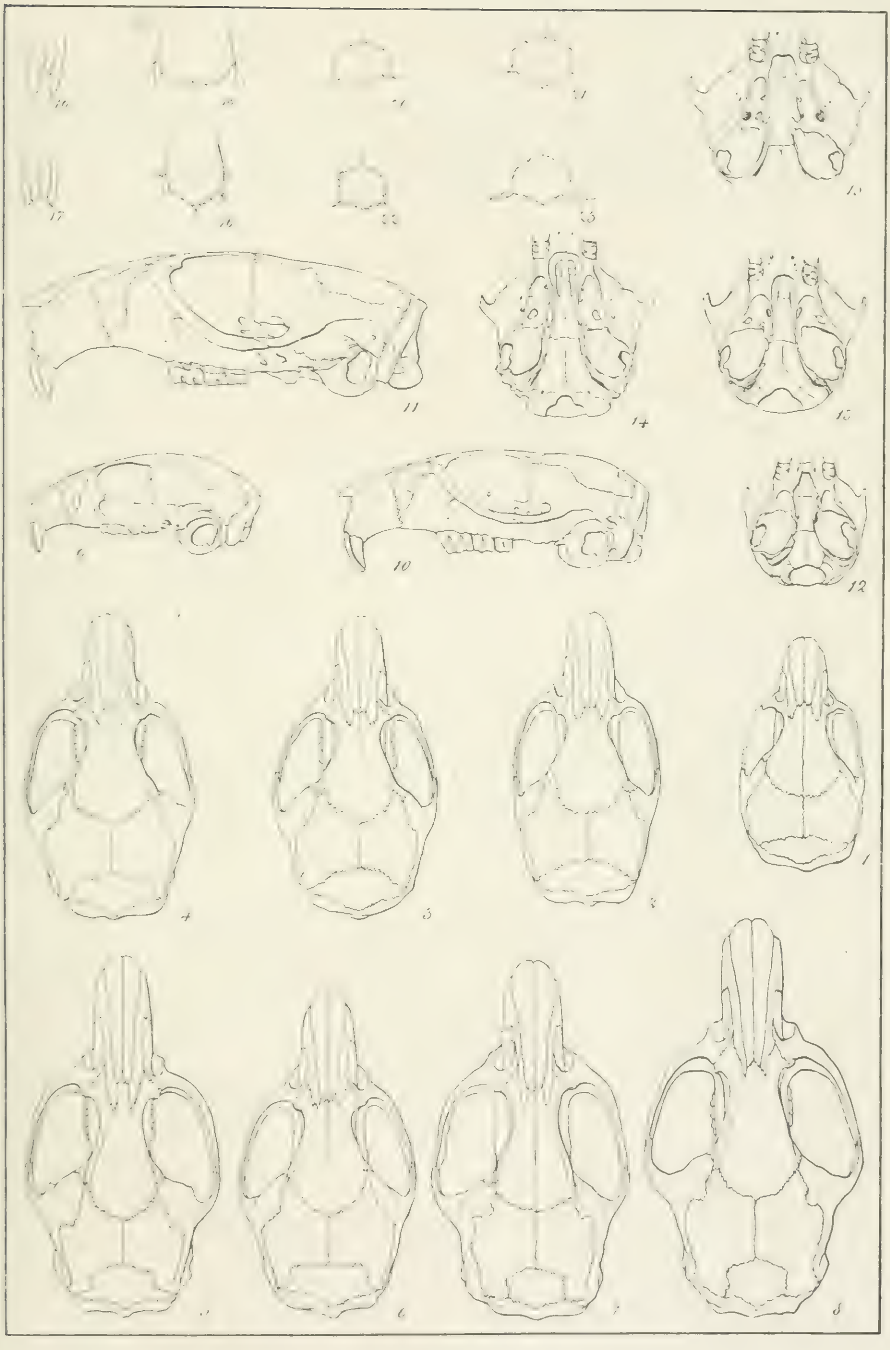
Figs. 12–15. Ventral aspect, showing variations in postpalatal region due to age. Fig. 12, No. 5834, ♀ juv. (nursling). Fig. 13, No. 5841, ♀ ad. (young adult). Fig. 14, No. 2958, Corpus Christi, ♂ ad. (very old). Fig. 15, No. 1456, *Neotoma cinerea occidentalis*, ♂ ad., Ducks, B. C. (for comparison with *N. micropus*).

Figs. 16, 17. To show extremes of individual variation in relative posterior extension of nasals and ascending branches of premaxillæ. Locality, Corpus Christi, Texas. Fig. 16, No. 2958, ♂ ad. Fig. 17, No. 2948, ♀ ad.

Figs. 18, 19. To show extremes of individual variation in posterior border of frontals. Locality, Corpus Christi, Texas. Fig. 18, No. 2949, ♂ ad. Fig. 19, No. 2951, ♂ ad.

Figs. 20–23. To show individual variation in the size and form of the interparietal. Specimens all from Corpus Christi, Texas. Fig. 20, No. 2949, ♂ ad. Fig. 21, No. 2948, ♀ ad. Fig. 22, No. 2952, ♂ ad. Fig. 23, No. 2945, ♀ ad.

NOTE.—If the Brownsville, Texas, series of specimens had also been included, the range of individual variation would have been considerably increased.


17
11
14
12
10
4
3
1
6
8

Neotoma micropus.

Figures nat. size.

Article X.—REMARKS ON SPECIMENS OF CHILONYCTERIS RUBIGINOSUS FROM WESTERN MEXICO, AND ON THE COLOR PHASES OF PTERONOTUS DAVYI GRAY.

By J. A. Allen.

The Museum has recently received from Dr. Audley C. Buller a small collection of Bats from the south shore of Lake Chapala, in the State of Michoacan, Mexico, among which are four specimens, referable to *Chilonycteris rubiginosus*. As the specimens have been freshly collected, and still retain the natural coloration of the membranes (not usually given in published descriptions), I append the following description based on them.

Pelage short, rather thin and very fine ; above dull brown, the fur uniform in color throughout ; below somewhat lighter grayish brown, the fur being slightly tipped with grayish. Ears and membranes everywhere pale brown, except the ventral surface of the interfemoral membrane, which is whitish or lead-colored. Alar and interfemoral membranes edged with whitish, forming a conspicuous border when seen from below, especially on the front edge of the alar and posterior edge of the interfemoral. Ears not white-edged, but whitish externally at the base. Membranes naked, except for a slight hairiness on the basal portion of the upper surface of the interfemoral. Ears naked externally except at the base ; internally with a few scattered hairs.

The four specimens, all males, vary but little in size, the forearm ranging in length from 53 to 57 mm. This is considerably smaller than the measurements of *C. rubiginosa*, given by authors.

C. rubiginosa has been reported from Dueñas, Guatemala, and also from Mirador (near Vera Cruz) in Mexico, the latter locality hitherto resting on a MS. list of Mexican Bats in the National Museum (*cf.* Alston, Biol. Cent. Am., Mam., p. 36). Through the kindness of Mr. Frederick W. True, Curator of Mammals in the United States National Museum, these specimens (Nat. Mus. Nos. 6181, ♂, and 6180, ♀, Mirador, Mexico, Dr. Sartorius) are now before me. They agree very nearly in size with the larger examples of the Lake Chapala series, but are radically different in color, being light reddish brown instead of dusky or blackish brown. The forearm measures 55 mm. in the female, and 59 mm. in the male, as against 53 to 57 mm. in the four males from Lake Chapala, and 62.2 mm. as given for this species by Dobson. Notwithstanding the smaller dimensions of the northern specimens, in view of the reputed wide range in color variation shown in this species, I deem it best to refrain from naming the Mexican animal, even subspecifically, especially in the absence of material from more southern points for comparison.

Note on Pteronotus davyi Gray.—With the four specimens of *Chilonycteris* above described were four examples of *Otopterus bulleri* (H. Allen) and six of *Pteronotus davyi*. These latter are of particular interest, inasmuch as they represent two widely different color phases, which are evidently independent of sex, age or season. The six specimens are all adult males except one, which is an adult female. Three of the males are in the "brilliant fulvous-chestnut" phase, for which Mr. Oldfield Thomas has recently proposed the subspecific name *fulvus* (Ann. and Mag. Nat. Hist., Ser. 6, X, p. 410, Nov., 1892); the other two males and the female are in the dark reddish brown dress of the ordinary Trinidad form of *davyi*. The length of the forearm ranges in the five males from 43 to 45 mm., the largest just equaling that of a single male specimen in Mr. Chapman's collection from Trinidad. Hence these specimens appear to conform closely in size with Mr. Thomas's series (l. c.), in which the forearm varied from 42.5 to 45 mm.

The single specimen (♂) previously recorded by me from the Plains of Colima (this Bulletin, III, p. 178, Dec., 1890) agrees also in coloration with Trinidad specimens; so that of the 12 specimens recorded by Mr. Thomas and myself from Mexico, four are colored as in Trinidad specimens and eight are of the "brilliant fulvous chestnut" type. It therefore seems doubtful whether this color difference is of subspecific importance. The smaller size of the northern examples appears to be parallel with what occurs in *Chilonycteris rubiginosus*, as above recorded.

Article XI.—NOTES ON SOME SPECIES OF NORTH AMERICAN ORTHOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.

By William Beutenmüller.

In advance of a descriptive catalogue of the Orthoptera found within a radius of fifty miles of New York City and adjacent districts, the following notes and descriptions of some apparently new species are presented.

Nemobius affinis, sp. nov.

Shining, head and thorax fusco-testaceous or wholly piceous and sparsely covered with rather long hairs. Antennæ longer than the body. Wing covers of the female not reaching the tip of the abdomen, and with a paler line along the angle where the wing covers turn down at the sides. In the male the wing covers extend to the tip of the abdomen. Hind wings absent in both the sexes. The abdomen above is blackish, with faint traces of some paler spots; on the underside the body is wholly testaceous, as are also the legs, but somewhat darker. Anal cerci extending beyond the ovipositor, which points obliquely upwards. Length of body about 6–8 mm.; ovipositor of female, 3–4 mm.; cerci, 3.5–4 mm.

Types: males and females, Coll. Am. Mus. Nat. Hist.

Collected in Connecticut and different places in the vicinity of New York City; also taken in abundance on Staten Island by Mr. Davis.

Closely allied to *Nemobius fasciatus*, form *vittatus*, but smaller and more shining. It also differs by the shortness of the ovipositor, it being about one-half as long, and by having the abdomen wholly testaceous beneath. The stridulation is a long, continuous, soft, rolling *whirrrrrr*. The insect occurs from the latter part of July until frost. It is found in the same places as *Nemobius fasciatus*, and is rather common.

This is the species described by Mr. W. S. Blatchley in the Proceedings of the Indiana Academy of Sciences, 1891, p. 136, as *Nemobius exiguus* Scudder. Dr. Scudder did not describe an insect under this name, but simply refers to Say's *Acheta exigua*

(Bost. Soc. Nat. Hist., Vol. VII, 1862, p. 429). Say's description of this latter species agrees fairly well with the little Cricket known to us at present as *Anaxipha pulicaria* (Burm.). This latter species was described from Jamaica, and is probably different from *Anaxipha exigua*.

Œcanthus nigricornis *Walker.*

Œcanthus fasciatus De Geer, Fitch, Rep. Nox. Ins. N. Y. Trans. N. Y. Agricul. Soc. 1856, p. 414 (in error).

Œcanthus nigricornis Walker, Cat. Derm. & Saltat. Brit. Mus. Gryllidæ, 1869, p. 93.

The description of *Œcanthus nigricornis* Walker agrees very well with the long-winged form of the species described by Fitch under the name of *Œcanthus fasciatus* De Geer. Fitch, however, erroneously mistook his insect for DeGeer's *Gryllus fasciatus*, which is a *Nemobius.* Consequently he did not give a name to his species, and Walker's name *nigricornis* should be used.

It is jet black with yellowish green elytra and wings. The first two joints of the antennæ have two black marks on each, those on the first joint usually confluent at the apex. These marks are mostly always obscured by the black ground color of the antennæ. It is found on low bushes in open fields and roadsides, and stridulates in the hottest sunshine. The stridulation is a long and comparatively loud, continuous *whirrrrrr*, often lasting several minutes.

Œcanthus 4-punctatus, sp. nov.

This name is proposed for the wholly pale green species with two black marks on the underside of the first two basal joints of each antenna, the innermost mark on the first joint nearly as long as the joint, and the outer one in shape of a spot ; on the second joint the marks are oblong and nearly equal. The antennæ are fuscous except the basal joint, which is pale green. The insect is at present known to us as a variety *Œ. nigricornis.* It is certainly distinct, since it does not breed together with *nigricornis.* Amongst the many individuals collected or observed by me in the field in *coitu*, I have never been able to find *Œ. 4-punctatus* in *coitu* with *Œ. nigricornis*, but always found the two species breeding separately.

Measurements.—Male : Length of body, 10 mm. ; pronotum, 2.5 mm. ; wing covers, 11 mm. ; hind femora, 7.5 mm. ; width of wing covers, when folded, 5 mm. Female : Length of body, 10 mm, ; pronotum, 2.5 mm. ;

wing covers, 10 mm. ; hind femora, 7 mm. ; width of wing covers, when folded, 3 mm.

Lives on low bushes in open fields, and the stridulation is the same as that of *Œ. nigricornis.*

Œcanthus angustipennis *Fitch.*

Fitch's description of *Œ. angustipennis* is entirely too brief for recognition of the species he intended to describe. It applies equally as well to *Œ. 4-punctatus* as to the insect determined by recent writers as *Œ. angustipennis.* Whether the latter has been correctly determined or not can never be definitely ascertained, as Fitch's type of the species, as well as all his other species of *Œcanthus*, have been destroyed. I would propose that the name *Œ. angustipennis*, nevertheless, be retained for the species so well known to us by this name. It may be easily recognized by being wholly pale greenish white, with the wing covers narrow, and by having one black mark on each of the first two basal joints of the antennæ ; the one on the first joint elongate and hooked at the base, with the hook turned inwards ; and the mark on the second joint shorter and slightly curved. The stridulation is a faint continuous *reeeeeé*, lasting about five seconds, and terminating abruptly, and with an equal interval of rest. It inhabits the high branches of trees, and is very seldom found on low bushes and shrubs. It stridulates late in the afternoon and by night.

Scudderia fasciata, sp. nov.

Head green, with a white line in front and a yellowish mark at the sides ; basal joint of antennæ green, following joints testaceous, becoming darker towards the extremity ; pronotum dark grass green, paler at the side, and a rather broad yellow stripe along the lateral carina ; wing covers dark grass green with a yellowish brown line running along the inner margin, and preceded by a blackish line running from the base to the apex ; another blackish line runs along the costal vein ; hind wings transparent, veins green and a green patch at the apex with a blackish dash ; sides of abdomen green, above purplish ; underside with a white and purplish stripe on each side, green along the middle ; tip of anal spines of the male and ovipositor of female reddish brown ; anterior legs green, femora testaceous at base ; middle legs green ; hind legs green, with the femora marked with black outside ; tibiæ with black spines ; tarsi of all the legs purplish brown ; the anal spines are like those of *S. angustifolia* and *S. furcata.*

Measurements.—Male: Length of body, 18 mm.; pronotum, 4 mm.; posterior femora, 18 mm.; wing covers, 25 mm. Female: Length of body, 21 mm.; pronotum, 4 mm.; posterior femora, 17 mm.; wing covers, 21–23 mm. Expanse, male, 61 mm.; female, 50 mm.

Types: three males and three females, Coll. Am. Mus. Nat. Hist. Collected at West Woodstock, Windham Co., Conn., on pine trees, September.

Scudderia truncata, sp. nov.

Somewhat resembles *Scudderia pistillata* in general appearance, but is considerably smaller. The wing covers are narrower and of almost equal width, with the costal margin curved; apex rounded; the eyes are larger and more protruding; pronotum narrower in front than behind, not much longer than broad. Supra-anal plate of male with no elongated process, but abruptly pointed with the apex truncate and minutely notched. The subanal process is long and slender, and abruptly turned upwards; much less curved than that of *S. pistillata*.

Measurements.—Male: Length of body, 15 mm.; wing covers, 26 mm.; posterior femora, 19 mm.

Described from a single male taken by the late Henry Edwards at Vineland, N. J. Type, Coll. Am. Mus. Nat. Hist.

This is probably the insect referred by Brunner von Wattenwyl to *Scudderia angustifolia* Harris (Monograph Phaneropteriden, 1878, p. 241). His description of the insect agrees with the specimen before me. Harris's *angustifolia*, however, was recently determined for me by Prof. Lawrence Bruner and Mr. W. S. Blatchley, and their determinations are alike, but differ from Brunner von Wattenwyl, and I am inclined to believe the former are correct. Harris's *angustifolia* is allied to *S. furcata*, while *S. truncata* is allied to *S. pistillata*. The figure of *angustifolia* in Harris's 'Report on Insects Injurious to Vegetation' agrees better with Bruner's and Blatchley's determinations than it does with that of Brunner von Wattenwyl.

Melanoplus punctulatus (*Scudder*).

The habits of this species are very different from those of the other members of the same genus. Instead of being an active creature, and living on the ground amongst grass like other species of *Melanoplus*, it inhabits pine trees, and is sometimes found in numbers on the same tree. It is quite sluggish, and may be easily taken without it making any or much effort to escape capture. Found during August and September.

Article XII.—DESCRIPTIVE CATALOGUE OF THE ORTHOPTERA FOUND WITHIN FIFTY MILES OF NEW YORK CITY.

By William Beutenmüller.

The object of the present paper is to enable those interested in the study of Orthoptera to determine the species found within a radius of fifty miles of New York City. Reference has also been made to those species which are likely to occur in this district.

The descriptions of the species and genera have all been taken from specimens in the collection of the American Museum of Natural History, and have in most cases been compared with the original descriptions and quotations taken therefrom.

Much assistance has been rendered me by the following gentlemen, to whom I herewith desire to express my sincere thanks for their kindness and readiness in aiding me in my work.

Mr. Wm. T. Davis for list of species and loan of specimens found on Staten Island; Prof. John B. Smith, of New Brunswick, N. J., and Mr. Nathan Banks, of Sea Cliff, L. I., for lists of species taken by them in their respective localities; Mr. A. P. Morse, of Wellesley, Mass., for list of Acrididæ of New England, and presentation of specimens of *Opomala brachyptera*, *Stethophyma lineata* and different species of *Spharagemon*, including types of his *S. saxatile* and *S. æquale scudderi;* Mr. Blatchley, of Terre Haute, Ind., for specimens of *Scudderia*, and Dr. S. H. Scudder and Prof. Lawrence Bruner for identification of doubtful species. The plates were drawn from nature by Mr. L. H. Joutel, and the figures in the text by Mr. R. L. Ditmars.

In order to properly understand the terms used in this paper, it has been thought advisable to insert the following cut, which was redrawn from the First Report of the U. S. Entomological Commission, p. 258.

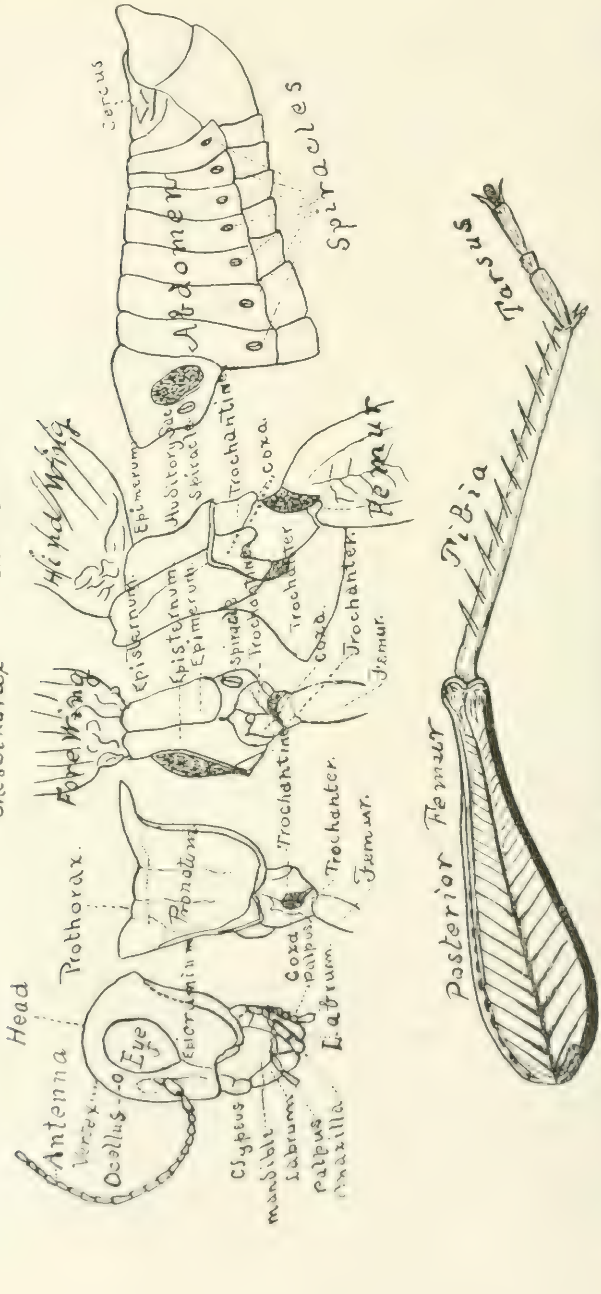

Antenna
Vertex
Ocellus
Head
Eye
Epicranium
Clypeus
mandible
Labrum
palpus
maxilla
Labium
palpus
Coxa
Prothorax
Pronotum
Trochanter
Trochanter
Femur
Mesothorax
Fore Wing
Episternum
Episternum
Epimerum
Spiracle
Trochantine
Trochanter
coxa
Trochanter
Femur
Metathorax
Hind Wing
Epimerum
Auditory Sac
Spiracle
Trochantine
coxa
Femur
Abdomen
Spiracles
Cercus
Posterior Femur
Tibia
Tarsus

FIG. 1 External Anatomy of *Melanoplus spretus*.

FORFICULIDÆ.—EARWIGS.

The members of this family may be known by their long, slender and flattened bodies, with the sides almost parallel, and the last abdominal segment furnished with a pair of forceps. Wings and wing covers present or absent.

Anisolabis *Fieber.*

Body long and slender, without wings, and of nearly equal width throughout; antennæ about half as long as the body, about 19-jointed. First and third tarsal joints of about equal length; second joint much smaller; forceps rather stout, slightly curved.

Anisolabis maritima (*Bonnell*).

PLATE V, FIG. 1.

Deep blackish brown, shining; underside considerably paler; legs pale luteous, also the antennæ at the base, and becoming darker towards the tip. Length, 15–22 mm.; forceps, 3–4 mm. Width, 3–4 mm.

Rather common at Sandy Hook, N. J., and along the banks of the Hudson River; also taken along the sea shore of Long Island and on Staten Island. Ranges throughout nearly the whole temperate and tropical world. Found under sticks, stones and rubbish during July and August.

Spongophora (*Serville*).

Body long and slender, flattened, with the sides of the abdomen straight; antennæ over half the length of the abdomen, 15–20-jointed, with the joints rather long; wings and wing covers present. First tarsal joint longer than the second and third together; third joint scarcely longer than the second; forceps nearly straight, very long and with a few teeth on the inner edge in the male; nearly unarmed in the female.

Spongophora brunneipennis (*Serville*).

Head, thorax and wing covers blackish brown; abdomen rich chestnut brown; wings yellowish, edged within and at the apex with dark chestnut brown; palpi luteous; antennæ 14–15-jointed, darker than the palpi; legs honey yellow; forceps simple, straight, incurved at the tip and half as long as the abdomen, with a quadrate basal tooth (female) or two-thirds as long as the abdomen, with a more or less prominent inner tooth before the middle. Length, 9 mm.; forceps, 3–4 mm.

Recorded from New Jersey, Pennsylvania southward to Mexico, and is probably also found in this vicinity.

Forficula *Linnæus.*

Body more or less flattened, usually long and slender; antennæ generally a little more than half as long as the body, 10–14-jointed, the joints cylindrical, scarcely longer at the apex than at the base, seldom less than four times as long as broad; wing covers present; wings sometimes present; first tarsal joint a little longer than the third, the second broadened at the apex and passing beneath the third joint; forceps of varied construction.

Forficula aculeata *Scudder.*

Dark chestnut brown; palpi and legs luteous; thorax longer than broad and narrower than the head, the sides pale luteous; wing covers nearly twice as long as the thorax, luteous, and broadly margined inwardly with deep chestnut brown; hind wings considerably shorter than the wing covers; male forceps about three-fourths as long as the abdomen, slender, arcuate, bent downward beyond the middle and again horizontal to the tip, before which is also a short tooth; pygidium with a long sharp point. Length of body, male and female, 9–11 mm.; forceps of male, 4–5 mm.; female, 2.5 to 3.5 mm.

Rare in this vicinity. Taken in May on Snake Hill, N. J., under stones. It probably also occurs in other localities in this vicinity.

Forficula pulchella *Serville.*

Head blackish; antennæ brown, paler at base; thorax brown, with the sides and hind margin paler; wing covers brown; wings yellow edged with brown; abdomen reddish brown; forceps of male arcuate in the middle, pointed, with an inner tooth near the base. Length of body, 8 mm.; forceps of male, 5 mm.; female, 2.5 mm.

Recorded from Niagara, N. Y., and will probably also be found in this vicinity.

Forficula auricularia *Linnæus.*

Fusco-ferruginous; antennæ 14–15-jointed; basal joint, sides of thorax and legs testaceous; wings and wing covers dull luteous, the latter half as long again as the pronotum; forceps of male usually as long as the abdomen, horizontal, depressed, and dilated at the base, and beyond rather strongly arcuate, tapering to a point, the extreme base of inner edge tuberculate-denticulate, with a distinct inner tooth at base of the arcuate portion. Body about 11 mm.; forceps, male, 4–8 mm.; female, 3 mm.

This species has been recorded from New York and New Jersey. It is also found in Cuba, Para, Europe, North Africa, West Asia and Madeira.

Labia *Leach.*

Size small; body long and flattened; antennæ about half as long as the body, 10–13-jointed; the joints rarely more than three times as long as broad; wing covers present; wings present or absent; first and third tarsal joints of equal length; second joint very small, simple and compressed; forceps about half as long as the abdomen, in the male, simple, curved; in the female, straight and incurved at the tip.

Labia minor (*Linn.*).

Much smaller than any of the preceding species. Light brown, pubescent; head blackish; antennæ 10–12-jointed, fuscous; mouth-parts pale; pronotum narrower than the head, and a little longer than broad; wing covers nearly twice as long as the thorax; hind wings as long as the pronotum; legs pale luteous; abdomen reddish brown in the middle above; forceps of male more than half as long as the abdomen, and distantly serrulate on inner edge; last segment of male with an apical, compressed, upcurved, long and slender tubercle. Length of body, 3.75–6 mm.; forceps, 1.25–2 mm.

Quite rare in this vicinity; May and June. Found from Maine to Texas; also in Europe, Siberia and Madeira.

Synopsis of Species of Forficulidæ.

Anisolabis.

Wing covers and wings wanting.
  Legs testaceous.......................................*A. maritima.*

Spongophora.

First tarsal joint longer than the other two together; wing covers and wings present.
  Forceps shorter than the pronotum, wings and wing covers together.......................................*S. brunneipennis.*

Forficula.

Second tarsal broad at apex, lobate and passing beneath the third joint.
  Last segment with a long sharp point.......................*F. aculeata.*
  Forceps of male with a basal tooth on the inner edge........*F. pulchella.*
  Forceps of male with an inner tooth at the arcuate portion, *F. auricularia.*

Labia.

First and third tarsal joints equal; second, minute and compressed.
  Last segment of male with a long apical tubercle..............*L. minor.*

BLATTIDÆ.—Cockroaches.

May be known by having the body elongate or broad and depressed; the pronotum shield-like, and the head bent down and sloping backwards. The legs are well developed for running, and are furnished with numerous spines. The wing covers overlap when at rest. Antennæ long and slender.

Phyllodromia *Serville.*

Body longer than broad; abdomen not broader than the thorax; sides of body almost parallel in the female and slightly narrowing from the base in the male; wing covers extending to the tip of the abdomen or a little beyond. Supra-anal plate truncate in the male; pointed and notched in the female.

Phyllodromia germanica (*Linn.*).

Yellowish brown, head and antennæ somewhat darker. The wings extend to the tip of the abdomen. On the thorax are two dark-brown longitudinal stripes. Length about 16 mm.; width, 4 mm.

This is the common small Roach which is so abundant in dwelling houses. It is commonly known as the Croton or Water Bug. It was imported from Europe during the time of the introduction of our Croton-water system, finding its way along the pipes from house to house. The eggs are laid in a capsule, containing about thirty-six eggs, attached to the end of the abdomen of the female. The insect is fond of warm places, especially around fireplaces and warm-water pipes. It breeds with great rapidity, and there are probably four broods a year in this vicinity.

Ichnoptera *Burmeister.*

Allied to *Periplaneta*. Abdomen elongate, slender, not wider than the thorax, sides almost parallel, tapering towards the end of body; wing covers much longer and broader than the abdomen. Anal plates rounded; subanal plate with two minute stylets bent downwards. Legs spined, but not as strongly as in *Periplaneta*. Antennæ about as long as the body.

Ichnoptera unicolor (*Scudder*).

Entirely uniform pale yellowish brown, without any markings whatever. The eyes are pitchy black, and the antennæ are slightly darker than the wings. The wings extend considerable beyond the abdomen. Length of body, 12 to 15 mm.; expanse of wings, 32 to 40 mm.

Found in woods under loose stones and the bark of trees during the day, and flying at light at night in June. The insect is very active when disturbed, and produces a crackling noise by rubbing its wing cases together.

Ichnoptera pennsylvanica (*De Geer*).

Much larger and darker in color than the preceding species. The median vein of the fore wings, dark; hind wings translucent, yellowish brown along the costa, veins dark; thorax dark brown, with a broad light border. Length about 16 mm.; expanse of wings about 50 mm.

Not common in woods under stones and loose bark of trees in June. Like the preceding species this species also produces a crackling noise when disturbed.

Periplaneta *Burmeister*.

Size large. Wings strongly developed, as long or longer than the abdomen. Subanal stylets long; anal plates truncate or pointed. Legs with long spines. Thorax as broad as the abdomen, narrower in front than behind, with the angles well rounded. Antennæ much longer than the body.

Periplaneta americana (*Linn.*).

PLATE V, FIG. 4.

Reddish brown; thorax pale with two reddish brown patches. The wings are well developed in both sexes, and extend beyond the end of the abdomen. Legs somewhat paler than the body. Antennæ much longer than the body, and extending beyond the tips of the wings. Length of body about 27 to 30 mm.; expanse of wings about 60 to 70 mm.

This is the largest species of Cockroach found in this vicinity. It inhabits houses, especially bake-shops, and feeds upon nearly everything. The wings are well developed, and adapted for flight.

Stylopyga *Fischer.*

Differs from *Periplaneta* in having the wings and wing covers in the female rudimentary, and in the male much shorter than the abdomen ; the outer border of the anterior pair of wings is also less rounded than in *Periplaneta.*

Stylopyga orientalis (*Linn.*).

PLATE V, FIGS. 2 AND 3.

Deep chestnut brown or piceous, with the legs and underside of body somewhat paler. The wings of the males do not reach the tip of the abdomen. The wings are absent in the female, and the wing covers are rudimentary. Length, about 22–27 mm.

This insect is sometimes one of the most disgusting household pests. It is nocturnal in habit, and feeds upon almost anything. It differs from *P. americana* by having the wings not reaching the tip of the abdomen in the male, and aborted in the female.

Panchlora *Burmeister.*

Abdomen broad, flattened, sides evenly rounded, anal plates notched. Thorax about as wide as the first abdominal segment, narrower in front than behind, angles well rounded, sides flattened. Antennæ about half as long as the body. Wings reaching the tip of the abdomen or a little longer ; tarsi spined ; femora unarmed.

Panchlora viridis (*Fabr.*).

Head pale yellowish green ; eyes brown. Thorax and body pale green, the former with a yellow band on each side before the margin, and the latter with a yellow shade along the back. Underside of body and the legs pale greenish white; wing covers semi-transparent, veins pale green, with a white basal streak, running below the anterior margin to nearly the middle of the wing. Hind wings transparent, with the veins also pale green. Length of body, about 18 mm. ; width, 8 mm.

This West Indian species is occasionally found in this vicinity, and may be easily recognized by its pale green color.

Ectobia *Westwood.*

Body about twice as long as broad ; wing covers scarcely reaching the tip of the abdomen ; subanal stylets of males absent ; antennæ longer than body ; supra-anal plate pointed ; subanal plate truncate, angles rounded.

Ectobia borealis (*Saussure*).

Body broad and stout, pitchy brown below, lateral edge light brown. Wing covers scarcely reaching the tip of the abdomen ; hind wings about half the length. Thorax broader than long, much rounded at the sides, chestnut brown, broadly margined in front and at the sides with yellowish white. Antennæ as long as the body. Head pitchy brown with light markings. Legs light brown with the spines darker. Wing covers chestnut brown with a rather long yellowish brown basal streak running along the anterior margin to about the middle of the wing. This light line is only dimly visible in dried specimens. Length, 16 to 20 mm. Width of body, about 7 to 8 mm. Width of thorax, 6 to 7 mm.

Not rare in this vicinity in woods under stones and bark. June and July.

Temnopteryx *Brunner.*

Abdomen almost as broad as long ; anal plates pointed ; thorax somewhat narrower than the abdomen, much narrower in front than behind, anterior angles well rounded, posterior angles acutely rounded. Wing covers very short ; hind wings rudimentary.

The species of this genus very much resemble larval forms of other species of *Blatta.*

Temnopteryx virginica *Brunner.*

Head and body above chestnut brown or piceous ; thorax bright chestnut ; legs and underside of thorax luteous ; underside of body lighter than above ; wing covers about one-third as long as the abdomen. Length, 8–12 mm. Width, 5–6 mm.

Common in woods under stones from April until September.

Synopsis of Species of Blattidæ.

Phyllodromia.

Body narrow, wings reaching the tip of abdomen.
  Thorax with two dark brown stripes. . . . . *P. germanica.*

Ichnoptera.

Wing covers much broader and extending considerably beyond the body.
  Size small ; uniformly yellowish brown. . . . . *I. unicolor.*
  Size large ; thorax dark brown, with light border. . . . . . . *I. pennsylvanica.*

Periplaneta.

Wings well developed, extending beyond the abdomen ; legs with strong spines.
  Chestnut brown ; thorax pale, with two chestnut brown patches, *P. americana.*

Stylopyga.

Wings not reaching tip of abdomen in the male ; rudimentary in the female.
  Wholly deep chestnut brown or piceous. . . . . *S. orientalis.*

Panchlora.

Abdomen very broad and flattened ; antennæ shorter than the wing covers.
  Pale green, thorax with a yellow stripe on each side ; wing covers with a white basal streak . . . . *P. viridis.*

Ectobia.

Body twice as long as broad ; wings reaching the tip of abdomen, antennæ longer.
  Thorax with a broad pale border ; wing covers with a pale basal streak. . . . . *E. borealis.*

Temnopteryx.

Wing covers about half as long as the abdomen.
  Wholly chestnut brown or piceous. . . . . *T. virginica.*

PHASMIDÆ.—WALKING STICKS.

Diapheromera *Gray.*

Wingless ; body stick-like, very long, slender, narrow and of almost equal width throughout ; antennæ very long and thread-like ; legs long and graceful; femora of middle legs swollen and provided with a prominent spine, in the male.

Diapheromera femorata (*Say*).

PLATE X, FIG. 10.

Wholly green, greenish or varying from very light to dark chocolate brown. Length, 65–85 mm.

This insect is popularly known as the Walking Stick. It is found in this vicinity during the latter part of August and in September, and is not rare. It feeds on the foliage of hazel, oak, hickory, locust and other trees and shrubs. The eggs are gray, oval in outline, and are dropped loosely on the ground in autumn and hatch the succeeding year. When at rest the insect mimics a green twig or dead branch.

GRYLLIDÆ.—CRICKETS.

The Gryllidæ may be known by their large globose head, with long thread-like antennæ. The wing covers are rather flat on top and abruptly bent downwards at the sides ; except in *Gryllotalpa* and *Tridactylus*, which have the wing covers oval, and the fore tibiæ very broad and toothed ; the other species have the anterior legs slender, and the posterior femora stout and swollen, except in *Œcanthus* where they are rather slender. The hind wings are folded when present ; and the wing covers of the males are provided with a stridulating organ.

Tridactylus *Oliver.*

Body glossy. Head and pronotum convex ; eyes oval ; antennæ short ; wing covers not reaching the end of the body ; wings longer or shorter, folded lengthwise like a fan. Anterior tibiæ broad and flat, armed at the end with four spurs ; all the tarsi very slender ; posterior femora long and broad, with a rounded shallow depression at the end. Body narrower than the thorax.

Tridactylus terminalis *Scudder.*

PLATE V, FIG. 15.

Head and thorax pitchy black, glossy, sometimes with reddish brown spots. The hind femora are black with two white spots or fasciæ. The wings reach to the tip of the abdomen, or extend a little beyond, in both sexes. Length about 7 mm.

Found from May to September in damp situations. The insect burrows perpendicularly in the ground ; the channel expanding at the bottom. According to Mr. Wm. T. Davis it is very difficult to capture, owing to its marvelous agility. The power of leaping is so great that it seems to disappear quite mysteriously, and one wonders which way it has gone, it being seldom that the departure can be accurately followed by the eye.

Gryllotalpa *Latreille.*

Head oval; thorax convex, sub-ellipical, sides rounded; body rounded and about twice as long as the thorax; anterior legs very stout and strong, broad and flattened, with four long spines at the tip and a movable claw-like organ outside, with two spines; middle legs short and slender; hind legs longer. Wing covers about half as long as the abdomen; hind wings half as long or longer than the abdomen.

Gryllotalpa borealis *Burmeister.*

Cinnamon brown, covered with short, fine hairs of the same color. The wing covers are less than one-half as long as the abdomen, and the hind wings extend a little beyond the wing covers. Length, about 30 mm.

This insect is commonly known as the Mole Cricket, so called from the enlarged fore feet, head and thorax, which wonderfully mimic a mole. It lives in damp places, especially along the borders of ponds and sandy banks of streams, where it burrows in the ground, and forms long channels with raised ridges, which very much resemble a miniature mole hill. The eggs are deposited in masses of from 200 to 300 in a round cavity deeper in the ground.

Gryllotalpa columbia *Scudder.*

Plate V, Fig. 5.

Differs from the preceding species by having the upper wings somewhat longer, and the hind wings extending beyond the tip of the abdomen. Length, 30–35 mm.

The habits are the same as in *G. borealis*, but the insect is less common, and it is probably nothing more than a long-winged variety.

Gryllus *Linnæus.*

Body stout; head large and globose; eyes large and rounded; antennæ thread-like, longer than the body; thorax broader than long, about as wide as the head; hind femora powerful, well developed and adapted for leaping; hind tibiæ with a double row of long spines growing longer towards the tip; anal cerci long and tapering; ovipositor of female as long or longer than the abdomen; wing covers as long or shorter than the abdomen bent down at the sides. Wing covers of male provided with a well-developed organ for stridulation; hind wings as long, longer or shorter than the abdomen, sometimes aborted.

Gryllus pennsylvanicus *Burmeister.*

PLATE V, FIGS. 6 AND 7.

Wholly shining jet black, covered with a very fine grayish pubescence on the thorax, legs and underside of body. In older examples this pubescence becomes abraded, and the insect is then very glossy. The wing covers are as long or more or less shorter than the body, and vary in color from ochraceous brown to pitchy black. The hind wings are shorter, or as long, or extend considerably beyond the wing covers, like tail-like projections. Length, 10 to 20 mm.; ovipositor, 12 to 15 mm.

The above description includes the forms known as *Gryllus luctuosus* Serv., *G. nigra* Harris, and *G. neglectus* Scud.

G. luctuosus is the form with the hind wings projecting like tails beyond the wing covers; *G. neglectus* is the form with the wing covers as long or shorter than the abdomen in the female and as long as the abdomen in the male; *G. nigra* is the form with somewhat shorter ovipositor.

This insect is very common everywhere in this neighborhood from May until frost, in open fields and woods, under stones, sticks and rubbish. The eggs are laid singly in loose soil, and the young crickets emerge in fourteen days. The egg is elongated, whitish, and is slightly curved; the sides almost parallel. Length, 2 mm.; width, .75 mm. The young cricket is pitchy black with a whitish longitudinal stripe on the middle of the head; the stripe is continuous along the back to the end of the body. The first abdominal segment is sordid white above and below. The thorax is also whitish beneath. At the end of body are two ferruginous bristle-like appendages with rather long hairs.

Gryllus abbreviatus *Serville.*

Head, thorax and body shining black. The legs vary from reddish brown to pitchy black. Wing covers fusco-testaceous, and as long or nearly as long as the abdomen. Hind wings shorter than the wing covers. The ovipositor of the female is very long. Length, 18–23 mm.; length of ovipositor, 18–21 mm.

This species may be distinguished from the preceding species by the remarkable length of the ovipositor of the female, and by the great size of the head. It is also a much heavier and clumsy species. Quite common in this vicinity, especially in the sandy districts of Long Island and New Jersey. The insect makes its appearance during August and lasts until frost. The eggs, as far as my experiments are concerned, do not emerge before the following year. *G. angustus* Scudder is the form which is less clumsy and considerably narrower than *G. abbreviatus.*

Gryllus domesticus *Linn.*

PLATE V, FIG. 8.

Pale brown, with chestnut-brown markings on the head and thorax. The wing covers extend to the end of the abdomen, and the hind wings extend considerably beyond. Length, 21 mm.; ovipositor, 12 mm.

This is the European House-cricket, or "cricket of the hearth," whose familiar chirp is so well known in houses, and especially about fireplaces. In this vicinity it is not common.

Nemobius *Serville.*

Small sized species, allied to the genus *Gryllus.* Head and thorax with comparatively long hairs; first and second joints of maxillary palpi minute, third and fifth joints of about equal length, fourth joint smaller. The venation of the wing covers of the female differs from *Gryllus*, the veins running longitudinally, while in *Gryllus* they run obliquely from both sides, thus forming lozenge-shaped spaces between. Hind tibiæ with long spines of unequal length. Ovipositor of female straight, longer or shorter than the abdomen.

Nemobius fasciatus (*De Geer*).

PLATE V, FIG. 9.

Dusky brown to almost piceous, with head and thorax hairy; the wing covers and legs sometimes paler. On the head are four black longitudinal stripes, which are only faintly visible in dried specimens. A black line also on each side of the thorax, continuous with a line of the same color along the sides of the wing covers. Body above black, with indications of two rows of pale spots. Underside pale brown with a broken, blackish, spot-like stripe on each side. In the male the pale portion of the underside of the body is usually reduced to a stripe along the middle. The ovipositor is straight, and pointed obliquely upwards, and is about as long as the hind femora. Spines on tibiæ of hind legs rather long. The wing covers in the male are as long or almost as long as the abdomen, and in the female they are about half as long. The hind wings are over twice the length of the wing covers, and project beyond like tails. Length, male and female, about 9–11 mm.; ovipositor, 8 mm.

Nemobius fasciatus, form **vittatus** (*Harris*).

PLATE V, FIG. 10.

This form only differs from *fasciatus* in having the hind wings aborted; in color, size and marking it is the same.

The form *vittatus* is exceedingly common in open wood and meadows in this vicinity. It is found from July until frost. The form *fasciatus* is quite scarce. The stridulation of this species is a continuous silvery, drop-like sound. It can be reproduced by taking a silver half-dollar between two fingers and striking the coin with the edge of a nickel.

Nemobius affinis *Beutenmüller.*

PLATE V, FIG. 11.

Shining; head and thorax fusco-testaceous or wholly piceous, and sparsely covered with rather long hairs. Antennæ longer than the body. Wing covers of the female not reaching the end of the body, and with a paler line along the angle where the wing turns down at the sides. In the male the wing covers reach the tip of the abdomen. Hind wings absent. The abdomen above in both sexes is blackish, with faint traces of some paler spots; on the underside the body is wholly testaceous, as are also the legs. Anal appendages extending beyond the ovipositor, which points obliquely upwards. Length, about 6–8 mm.; ovipositor, 3–4 mm.; anal appendages, 6.5 mm.

Closely allied to *Nemobius fasciatus*, form *vittatus*, but is much smaller and more shining. It also differs by the shortness of the ovipositor, it being about one-half as long, and by having the abdomen wholly testaceous beneath. The stridulation is a long, continuous, soft, rolling *whirrrrrrr.* The insect occurs from about the latter part of July until frost. It is found in the same places as the preceding species, and is rather common.

Anaxipha *Saussure.*

Closely allied to *Nemobius*, but differs by having the ovipositor of the female sabre-like and curved upwards with the end compressed. The antennæ are very long, about five times as long as the body, and the spines of hind tibiæ are of equal length. Wing cases of male almost encasing the abdomen, with a round glassy patch on top near the end of the wing. Hind wings absent.

Anaxipha exigua (*Say*).

Head and thorax testaceous with a few short hairs, and the former with three blackish lines in front, connivant at the mouth parts. Antennæ very long, about five times as long as the insect. Wing covers paler than the thorax, reaching the end of the abdomen in the male and somewhat shorter in the female. Hind wings absent. Abdomen of male black; abdomen of female pale testaceous above and below, black laterally. Ovipositor curved, chestnut brown. Length about 5 mm. Ovipositor, 2 mm. Antennæ, 20 mm.

This insect is not uncommon in this vicinity, and occurs from August until late in October. It is most common during late August and early September. It lives mostly on bushes, rarely on the ground, and especially on bushes growing in salt meadows. According to Mr. Davis it clings to the stems from six inches to a foot above the ground, and its song has a particularly silvery tone.

Phylloscirtus *Guérin*.

Small sized. Head broader than the thorax; eyes prominent and protruding. Antennæ long, hair-like; ocelli absent; last joint of maxillary palpi exceedingly broad, spoon-like; last joint of labial palpi similar but very much smaller; thorax longer than broad; abdomen almost entirely encased by the wing covers; hind wing present or wanting; wing covers of female with parallel longitudinal veins; ovipositor sabre-like, short, and curved upwards; sides of wing cases of male bent obliquely downwards; hind legs graceful, with weak spines on the tibiæ.

The species of this genus somewhat resemble small Cicindelas, and may be at once recognized by the very broad spoon-like joints of the palpi.

Phylloscirtus pulchellus (*Uhler*).

Plate V, Fig. 16.

Head and thorax bright crimson red, the latter with the lateral margins narrowly bordered with white; palpi black; antennæ much longer than the body, black at base, then whitish for some distance, then again blackish to the tip. Abdomen shining jet black; wing covers chestnut brown or almost black. Legs yellowish. Length, 7 mm.

Rather scarce in this vicinity. It is found on shrubs and limbs of trees, during September and October.

Apithus agitator *Uhler.*

It is possible that this insect may be found in the vicinity of New York City. It is a southern species, and may be looked for in southern New Jersey. It inhabits grape vines and dense shrubbery, and is found fully developed in September.

Orocharis saltator *Uhler.*

Like the preceding, this is also a southern species, and possibly may occur here. It also inhabits shrubbery and trees.

Œcanthus *Serville.*

Thorax elongated, narrow, sides deflexed, anterior portion somewhat narrower than the posterior portion. Antennæ about twice as long as the body. Hind legs long and slender, with weak spines on the tibiæ. Wings of female wrapped around the body. Wing covers of male flattened and transparent.

The members of this genus may be easily known by their narrow and slender hind legs and structure of the wings.

Œcanthus niveus (*De Geer*).

PLATE V, FIGS. 12 AND 13.

Wholly pale, whitish green with two slightly elevated black dots on the underside of each antenna, one on the first and one on the second joint. Top of head and first joint of antennæ usually pale yellowish brown. Tip of ovipositor of the female black. Wing covers almost twice as long as the abdomen ; hind wings as long as the upper. Average length, from head to tip of wings, 16 mm. ; body, 11 mm. ; width of male wing covers, 6 mm. ; female, 3 mm.

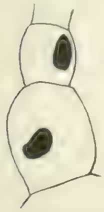


FIG. 2. Underside of basal joints of antennæ of *Œ. niveus.*

Very abundant during August and September in gardens and open woods, on vines and trees. The stridulation of this insect is very shrill and only heard at night, but sometimes also on cloudy days and in dark places in the shrubbery, when the song is quite faint.

The stridulation is a continuous, pulsating, equally sustained *trrr-reee-trrr-reee*, etc. ; it has also been described as a pulsating sound like *re-teat*, *re-teat*, or *a-beat*, *a-beat*.

Œcanthus angustipennis *Fitch.*

Wholly pale greenish white; wings transparent and sometimes with a pale yellowish-brown patch on top of the head. Antennæ with two elevated black marks on the underside, the one on the first joint hooked at the base, with the hook turned inward and the mark on the second joint oblong. Average length from head to tip of wing covers, 14 mm.; body, 10 mm.; width, 3.5 mm.

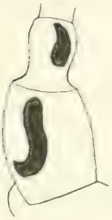


FIG. 3.
Underside of basal joints of antennæ of *Œ. angustipennis.*

This species is not as common as *Œ. niveus.* It inhabits the higher parts of different kinds of forest and fruit trees. The stridulation is very different from *Œ. niveus.* It is a faint, continuous *reeeeeeé*, lasting about five seconds, and terminating abruptly, with an equal interval of rest. Usually sings at night only, but sometimes also late in the afternoon in shady places, and on cloudy days. The insect may be readily separated from *niveus* by the much narrower wing covers and the different shaped marks on the basal joint of the antennæ. Found from August until the colder weather sets in.

Œcanthus nigricornis *Walker.*

Yellowish green, with three more or less distinct black, longitudinal stripes on the head and thorax, which are sometimes entirely black. The legs are yellowish with a blackish tinge, or entirely black. Underside of body black; upperside yellowish green. Antennæ black with four black marks on the first two joints. The innermost mark on the first joint about twice the length of the outer, and nearly always confluent at the upper ends. On the second joints the marks are more equal. In many individuals the antennæ are entirely black; then the marks are not discernible. Hind wings extending more or less beyond the wing covers. Average length from head to tip of wing covers, 15 mm.; body, 11 mm.; width, male, 4.5 mm., female, 3 mm.

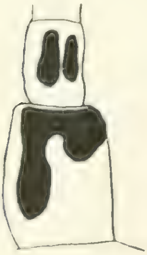


FIG. 4.
Underside of basal joints of antennæ of *Œ. nigricornis.*

Our most common species in this vicinity. It is found from the latter part of July until frost, along roadsides and in open fields on low bushes. The stridulation is a very shrill, continuous *whirrr*, often lasting several minutes. It sings in the hottest sunshine and by night.

Œcanthus 4-punctatus *Beutenmüller.*

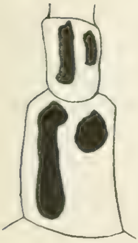


Fig. 5.
Underside of basal joints of antennæ of *Œ. 4-punctatus.*

Wholly pale yellowish green, with the antennæ fuscous; basal joints yellowish green with two black marks on the underside of each of the first and second joints. The marks are similar to those of *Œ. nigricornis*, but are not united on the first joint as is usually the case in *nigricornis.* The wings protrude more or less beyond the wing covers. Size about the same as *Œ. nigricornis.*

Found in the same localities with *Œ. nigricornis*, and it is possible that it may be a form of that species.

Œcanthus pini *Beutenmüller.*

Head and antennæ testaceous, the latter becoming darker towards the tip; first two joints with four black marks; the inner mark on the first joint long and straight, the outer oblique; those on the second joint parallel; eyes black; thorax testaceous with a longitudinal line on each side above; anterior pairs of legs testaceous; posterior femora green, tibiæ testaceous; body beneath black with the sides yellowish green; body above blackish with a green stripe along the back; elytra transparent, with grass-green veins; hind wing slightly protruding beyond the elytra; veins also green.

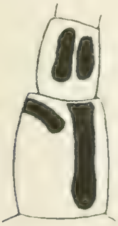


Fig. 6.
Underside of basal joints of antennæ of *Œ. pini.*

The female is somewhat paler than the male, and the wings extend a little more beyond the elytra; ovipositor dark testaceous, tip black. Average length from head to tip of wing covers, 14 mm.; body, 12 mm.; width, 4.5 mm.

Somewhat resembles *Œ. nigricornis*, but may be readily distinguished from it by the grass-green color of the wings and the testaceous head and thorax, and marks on basal joints of the antennæ. This insect lives only on pine trees, and usually on the high branches. Its song is a continuous, soft and metallic *reeeeeeeeee*, with numerous undulations. When many individuals are heard together, their stridulations sound not unlike the jingling of sleigh-bells at a distance.

Has been found by me in Windham Co., Conn., and it is not unlikely that the insect also occurs in this vicinity. It should be looked for in the pine districts.

Œcanthus latipennis *Riley.*

Pale yellowish green, with the wing covers very much broader in the male than in any other species of the genus. The antennæ are destitute of black marks on the underside of the first two joints, which are characteristic of the other species of *Œcanthus.* The basal joints of the antennæ and top of head are of a distinct pink color. The wing covers extend considerably beyond the abdomen, and the wings in the male are much shorter than the wing covers, and in the female about as long. Average length from head to tip of wing covers of male 16 to 19 mm.; width of wing covers, 7-8 mm.; female, 14-17 mm.; width, 3-4 mm.

Quite scarce in this vicinity, but not uncommon in certain localities on Staten Island. The insect lives on low plants, in damp places. The stridulation is a shallow, continuous trill lasting for some time, with indefinite intervals of rest. Sings late in the afternoon and by night. Found during September and October. Easily distinguished from the other species by the pink color of the basal joints of the antennæ and top of head.

Xabea *Walker.*

Body smooth, shining, slender; head broader than the thorax; antennæ with a rather short tubercle on the underside of the basal joint; first and second joints of the maxillary palpi cylindrical, minute; third joint very long and slender; fourth joint much smaller than the second, clavate; fifth joint longer than the third, straight on one side and swollen on the other, apex oblique; thorax long, sides parallel; wing almost twice as long as the wing covers; legs pubescent; hind tibiæ without spines. In form and general appearance this genus very much resembles *Œcanthus*, but differs in having the hind tibiæ unarmed, different palpi, and long hind wings.

Xabea bipunctatus (*De Geer*).

Plate V, Fig. 14.

Pale pinkish brown, with two rather large blackish spots on each of the upper wings in the female. The hind wings very long and extend much beyond the upper wings, and have a decided opalescent hue when expanded. The legs are pale with a pinkish hue. In the male the dark spots on the upper wings are absent. Length to tip of wing covers about 17 mm.; body about 13 mm.; width about 5 mm.; female, 4 mm.

Easily recognized by its pinkish-brown color and the dark spots on the wing cases in the female.

Synopsis of Species of Gryllidæ.

Tridactylus.

Antennæ shorter than body, anterior tibiæ flattened and armed with teeth.
Small species : glossy black, sometimes marked with red . . . *T. terminalis.*

Gryllotalpa.

Antennæ shorter than body ; anterior tibiæ flat, armed with teeth and a movable, claw-like organ outside.
Large species : brown, covered with short hairs.
Wing covers less than half the length of abdomen ; wings extending a little beyond wing covers . . . . *G. borealis.*
Wing covers more than half the length of abdomen ; hind wings very long . . . . *G. columbia.*

Gryllus.

Antennæ longer than the body ; wing covers abruptly bent down at sides.
Black, wing covers sometimes brown ; ovipositor, 12–15 mm. long.
Hind wings short ; wing covers as long as the abdomen, *G. pennsylvanicus.*
Hind wings extending beyond the wing covers, like tails, form *luctuosus.*
Wing covers shorter than the abdomen in the female, hind wings abbreviated . . . . form *neglectus.*
Ovipositor rather short . . . . form *nigra.*
Wing covers always testaceous.
Form robust ; hind femora usually ferrugineous ; ovipositor, 18–21 mm. long . . . . *G. abbreviatus.*
Much more slender than *abbreviatus* . . . . form *angustus.*
Pale testaceous, head and thorax with chestnut-brown markings, *G. domesticus.*

Nemobius.

Small species, allied to *Gryllus ;* with rather long hairs ; hind tibiæ with unequal spines.
Underside of abdomen with a testaceous stripe along the middle ; ovipositor very long.
Hind wings extending beyond the wing covers like tails, *N. fasciatus.*
Hind wing aborted . . . . form *vittatus.*
Underside wholly testaceous beneath ; ovipositor short. . . . . . . *N. affinis.*

Anaxipha.

Small size ; antennæ exceedingly long ; spines of hind tibiæ equal in length ; ovipositor sabre-like.
Wholly pale testaceous ; abdomen black beneath . . . . *A. exigua.*

Phylloscirtus.

Head broader than thorax ; last joints of palpi enlarged, spoon-like.
Head and thorax crimson red . . . . *P. pulchellus.*

Œcanthus.

Hind leg slender, tibiæ with weak spines.
Antennæ with one black mark on the two basal joints :
Wing covers broad ; marks on antennæ in shape of small dots, *Œ. niveus.*
Wing covers narrow ; mark on first joint of antennæ long and hooked at base ; mark on second joint oblong, *Œ. angustipennis.*
Antennæ with two black marks on the first two basal joints :
Head, thorax, legs and antennæ usually black ; marks on first joint of antennæ generally connected at apex . . . . *Œ. nigricornis.*

Wholly pale greenish white, transluscent ; marks on antennæ
elongate, parallel, distinct .. .. *Œ. 4-punctatus.*
Head, thorax and legs testaceous ; hind femora, veins of wings
grass-green ; inner marks on first joints of antennæ straight,
the outer oblique ; on second joint, parallel.......... *Œ. pini.*
Antennæ without marks on underside of first two joints.
Wing covers very broad ; head and basal joints of antennæ
pink ....*Œ. latipennis.*

Xabea.

Hind legs slender, tibiæ without spines.
Pinkish brown ; first joint of antennæ tuberculate beneath,
X. bipunctatus.

LOCUSTIDÆ.—GRASSHOPPERS.

The species of this family, found in this vicinity, are divided into five subfamilies, which may be separated by the following characters :

Prosternum without spines.
Wing covers broad ; hind wings longer than wing covers ; vertex
not elongated into a cone or tubercle............PHANEROPTERINÆ.
Prosternum with long slender spines.
Wing covers and wings very broad ; concave ........PSEUDOPHYLLINÆ.
Wing covers narrow, tapering towards the apex, shorter than the
hind wings ; head with a blunt tubercle or prominent cone,
CONOCEPHALINÆ.
Wings and wing covers rudimentary.
Pronotum extending over the first abdominal segment ; prosternum
with spines................ ....DECTICIDINÆ.
Wings and wing covers absent.
Pronotum not extending over the first abdominal segment ; prosternum without spines.... .... STENOPELMATINÆ.

PHANEROPTERINÆ.

Scudderia *Stål.*

Head oval ; eyes round and protruding, vertex pinched ; antennæ longer than the wings, first joint cylindrical, stout ; second joint smaller, remaining joints hair-like. Thorax longer than broad, narrower in front than behind ; lateral carina sharply defined. Wing covers shorter than the wings and nearly of equal width throughout, apex rounded. Hind legs very long and slender. Male with the anal plates provided with two curved spines, the one from the supra-anal plate curved downward and notched at the end, and the one from the subanal curving upwards and grooved above. Female with the ovipositor short, broad, flat and turned upwards, with the apical portion very finely serrate.

The species of this genus may be known by their narrow wing covers and the singular anal processes of the male.

Scudderia curvicauda (*De Geer*).

PLATE VII, FIGS. 5 AND 6.

Wing covers, legs and thorax pale grass green ; head and underside of body paler ; pronotum much longer than broad, narrower in front than behind, and with a yellow line along the lateral carina. The notch of the supra-anal spine is square, with a minute median tooth, the lateral parts of the notch compressed.

Measurements.—Length of body, 22–25 mm. ; wing covers, 33–37 ; posterior femora, 25–27 mm.

Common everywhere in this vicinity from August until late in the fall. The insect may be found clinging to tall grasses, weeds and low bushes in meadows, especially in damp places.

Scudderia furculata *Brunner*.

Very much resembles the preceding species, but may be separated from it by the notch of the supra-anal spine of the male being acute and the sides of notch rounded, flattened at the end and compressed beneath into a small flat process. The female is very difficult to separate, but lacks the black color at the basal fold of the ovipositor.

Measurements.—Male : Length of body, 20–23 mm. ; wing covers, 34–38 mm. ; posterior femora, 24–30 mm. Female : Length of body, 22 mm. ; wing covers, 34 mm. ; posterior femora, 27 mm.

Found in the same localities as *S. curvicauda*, from August until late in fall. Not common.

Scudderia furcata *Brunner*.

Grass green ; wing cover narrow and of equal width throughout, apex rounded ; lateral carina of pronotum without trace of a yellow line. The notch of the supra-anal spine of the male is very deep, and the lateral pieces very much swollen.

Measurements.—Male : Length of body, 16 mm. ; wing covers, 31 mm. ; posterior femora, 23 mm. ; pronotum, 5 mm. ; width of wing covers, 6 mm. Female : Length of body, 20 mm. ; wing covers, 30 mm. ; posterior femora, 22 mm. ; ovipositor, 5 mm.

Very common from early in August until late in fall. Found on low bushes and grasses, especially in damp meadows and roadsides.

Scudderia angustifolia (*Harris*).

Very closely allied to the preceding species, but somewhat smaller, and has the hind femora shorter, and the wing covers narrower; there is also a distinct yellow line along the lateral carina of the pronotum. In color it is the same as *S. furcata*.

Measurements.—Male: Length of body, 14–15 mm.; wing covers, 25–26 mm.; pronotum, 4 mm.; posterior femora, 19–20 mm. Female: Length of body, 19–21 mm.; wing covers, 25 mm.; ovipositor, 5.5 mm.

Common in the same localities as the preceding species. August until late in fall.

Scudderia fasciata *Beutenmüller*.

Head green, with a white line on the face, and at the sides a yellowish mark; basal joint of antennæ green, following joints dark testaceous, becoming darker towards the apex; pronotum dark grass green, paler at the sides, and a rather broad yellow stripe along the lateral carina; wing covers dark grass green with a pale yellowish brown shade along the inner (dorsal) margin, preceded by a blackish line running from the base of the wing to the apex; another blackish line runs along the costal vein; hind wings transparent, veins green and a dark green apical patch shaded with blackish; sides of abdomen green, above purplish; underside with a white and purplish stripe on each side, and green along the middle; tip of anal spines of the male and ovipositor of female reddish brown; anterior legs green, femora testaceous at the base; middle legs entirely green; hind legs green, with the femora marked with black outside; tibiæ with black spines; tarsi of all the legs purplish brown.

Measurements.—Male: Length of body, 18 mm.; pronotum, 4 mm.; posterior femora, 18 mm.; wing covers, 25 mm.; expanse, 61 mm. Female: Length of body, 21 mm.; pronotum, 4 mm.; posterior femora, 17 mm.; wing covers, 21–23 mm.; expanse, 50 mm.

This species occurs on pine trees, and in color very much assimilates to the leaves of this tree. It has been found in Connecticut and near Ithaca, N. Y.

Scudderia pistillata *Brunner*.

Apex of vertex concave; pronotum narrower in front than behind; wing covers very broad, wider at the middle than at the base and apex, with radiating veins; anterior margin curved, inner margin quite straight, apex rounded; supra-anal process notched at the apex, with short, rounded lobes; subanal process extending a little beyond the upper process.

Measurements.—Male : Length of body, 16–20 mm. ; wing covers, 29–31 mm. ; posterior femora, 21–23 mm. Female : Length of body, 18–20 mm. ; wing covers, 27–30 mm. ; posterior femora, 21–23 mm.

This species may be easily recognized by the broad wing covers. It is found in the same localities as *S. curvicauda*, but is rare. August and September.

Scudderia truncata *Beutenmüller.*

Somewhat resembles *S. pistillata*, but is much smaller, the wings are narrower and almost of equal width, with the anterior margin curved and the inner margin somewhat concave, apex rounded ; eyes protruding and larger than those of *S. pistillata* ; pronotum narrower in front than behind, somewhat concave ; supra-anal plate of male with no elongated spine, but is abruptly pointed with the apex truncate and minutely notched. The subanal process is long and slender, suddenly turned upwards, and much less curved than that of *S. pistillata.*

Measurements.—Male : Length of body, 15 mm. ; wing covers, 26 mm. ; posterior femora, 19 mm.

Very rare in this neighborhood. Taken at Vineland, N. J.

Amblycorypha *Stål.*

Head with the vertex flat ; eyes elliptical or oblong oval ; antennæ thread-like, first joint large and thick, second joint but slightly smaller, third joint slender. Wing covers broad and rounded at the tip. Male with the supra-anal plate truncate ; subanal plate short and broad at base, narrower at apex, with a deep triangular notch, each tip with a short blunt spine-like process. Female with a long, flat, curved ovipositor, deeply serrated towards the end.

Easily recognized by the broad oblong rounded wing covers.

Amblycorypha rotundifolia (*Scudder*).

PLATE VI, FIG. 2.

Wing covers oblong oval, pale pea-green, body somewhat paler ; hind wings transparent, with the veins and apical patch green ; posterior femora with four or five small spines and reaching to the tip of the wing covers ; ovipositor of female strongly curved upwards and strongly serrated at the apical portion.

Measurements.—Length of body, about 20 mm. ; wing covers, 27 mm. ; posterior femora, 23 mm.

Common in this vicinity from the latter part of July until late in September. It inhabits thickets, or is found on bushes and shrubbery in open places.

Amblycorypha oblongifolia (*De Geer*).

Allied to *A. rotundifolia*, but is longer and broader. The wing covers extend beyond the posterior femora, and the anterior portion of the thorax is considerably narrower than the posterior. Color pale pea-green, sometimes wholly rose color. Lower carina of posterior femora with about ten strong teeth.

Measurements.—Length of body, 21 mm. ; wing covers, about 38 mm. ; posterior femora, 30 mm. Expanse of wings, 75 to 85 mm.

Rather common in this neighborhood during August and September until frost. Found in similar places with the preceding species. Instead of being green, this insect is sometimes entirely rose colored.

Microcentrum *Scudder.*

Larger and stouter than *Amblycorypha*. Vertex of head with a transverse furrow ; eyes oval, prominent ; pronotum a little longer than broad, anterior portion slightly narrower, lateral carina sharp. Wing covers broad, and gradually sloping from the middle towards the apex, which is rounded and quite pointed, thus making the outer portion of the wing covers, beyond the middle, somewhat triangular. Hind femora about half as long as the wing covers. Supra-anal plate triangular. Subanal plate of male forked at the tip, similar to that of *Amblycorypha*. Ovipositor of female quite short, broad and abruptly curved upwards, blunt at the tip.

Microcentrum laurifolium (*Linn.*).

PLATE VI, FIG. 3.

Wing covers grass green, with the venation conspicuously marked, extreme anterior edge light brown ; hind wings transparent, with green veins ; body light green or clay colored.

Measurements.—Length of body, 28 mm. ; pronotum, 6 mm. ; wing covers, 46 mm. ; posterior femora, 26 mm. ; width of wing covers, 14 mm. ; pronotum, 5.5 mm. ; expanse of wings, 95 mm.

Quite rare in this vicinity, but more common in the Southern States. It may be easily recognized by its large size and leaf-like resemblance of the wing covers, especially when the wings are closed. It may also be known by its short posterior femora and tibiæ, which in the two preceding species are much longer. The eggs are gray, oval and very flat, and laid on the edge of a leaf in single or double chain-like rows, the edges of the eggs overlapping one another.

PSEUDOPHYLLINÆ.

Cyrtophyllus *Burmeister.*

Head large and stout; eyes hemispherical and comparatively small; vertex spine-like; antennæ almost twice as long as the wings; pronotum as broad as long on top with two transverse furrows; lateral carina well rounded, lobes of sides parallel, with angles acutely rounded; wings concave; wing covers longer than the hind wings, a little more than twice as long as broad, and of almost equal width, with the apex obtusely rounded. Anterior pairs of legs long and rather stout, and well adapted for climbing; hind legs almost twice the length and also stout. Supra-anal plate longer than broad, and bluntly rounded at the tip; subanal plate of male very long, paddle-shaped, and grooved on the upper side; ovipositor of female quite long and curved upwards beyond the middle.

Cyrtophyllus concavus (*Harris*).

PLATE VI, FIG. I.

Wing covers and thorax bright green; head, legs and body much paler; hind wings transparent. When the insect is at rest the wing covers curve around the body, so that their edges touch above and beneath; pronotum roughly punctured and somewhat wrinkled; head smooth.

Measurements.—Length of body, 30–35 mm.; wing covers, 33–36 mm.; posterior femora, 19–21 mm.

This is the well-known Katydid. It may be readily known by its robust form and broad, concave wings. The insect is arboreal in habit, living on the branches in the dense foliage of the tops of trees. Common in this neighborhood during August and September until the colder weather.

CONOCEPHALINÆ.

Conocephalus *Serville.*

Head with the vertex more or less prolonged forward and upward into a cone, with a pointed tooth beneath; face very oblique; pronotum flat, narrower in front than behind; lateral carina quite sharp, lobes of side curving obliquely backwards in front and well rounded behind. Wing covers narrow, broader at the base than the apex. Hind wings long and quite narrow. Cerci of male swollen, curved inwards and toothed. Ovipositor of female very long and straight.

The species of this genus are readily known by having the vertex prolonged into a cone-like process, and by the narrow wings.

Conocephalus robustus *Scudder.*

Plate VI, Fig. 9.

Wholly bright green or pale brown, with the wing covers sometimes sparsely speckled with black. Cone of vertex pronounced and obtusely rounded at the apex, entirely green or with a slight touch of black at the apex, beneath ; the tooth before the middle small and blunt ; pronotum with a yellow stripe along the lateral carina and running along the head to the apex of the cone. Wing covers extending considerably beyond the posterior femora, quite broad at base in the male, with the singing apparatus well developed. The wing covers of the female are narrower, and the ovipositor somewhat longer than the posterior femora. Hind wings of both sexes almost as long as the wing covers.

Measurements.—Male : Length of body, 30 mm. ; wing covers, 46 mm. ; posterior femora, 24 mm. ; expanse, 96 mm. Female : Length of body, 35 mm. ; wing covers, 48 mm. ; posterior femora, 25 mm. ; ovipositor, 26 mm. ; expanse, 96 mm.

This insect is very common in this vicinity, especially in the salt meadows of Long Island, Staten Island and New Jersey, amongst the tall grasses and rushes. Its song is exceedingly loud and shrill, and can be heard at a considerable distance ; when the insect is near the sound is quite deafening. It is a continuous *bzzzzzzz*, increasing and decreasing in volume. It somewhat resembles the song of the Harvest-fly (*Cicada canicularis*). August and September.

Conocephalus exiliscanorus *Davis.*

Plate VII, Figs. 1 and 2.

Very much resembles *C. robustus*, but may be distinguished from it by the very long, sharp cone on the head, which projects upwards ; the underside of the cone is shining black from the sharp-pointed tooth near the base to the apex. The wings are shorter than in *C. robustus*, but are equally as broad. The ovipositor of the female is much longer than the posterior femora, while in *C. robustus* it is about as long. The tooth on the underside of the cone of the head is also sharper and more prominent, and the head is longer and broader.

Measurements.—Male : Length of body, 34 mm. ; wing covers, 39 mm. ; posterior femora, 23 mm. ; expanse, 85 mm. Female : Length of body, 40 mm. ; wing covers, 43 mm. ; posterior femora, 23 mm. ; ovipositor, 38 mm. ; expanse, 92 mm.

Found from the latter part of July until cold weather in the salt marshes and meadows of Staten Island. Its song is very different from that of *C. robustus*, instead of the loud, shrill buzz, it is much slower, being a continuous shrill *a-zip—a-zip—a-zip*, or *zit-zit-zit*, etc. Sings late in the afternoon and at night.

Conocephalus ensiger *Harris.*

PLATE VI, FIG. 8.

Much smaller and more graceful than the two preceding species. The cone on the head is similar to that of *robustus*, but has a black line on each side beneath, running from about the middle of the apex.

Measurements.—Male: Length of body, 26–28 mm.; wing covers, 38–40 mm.; posterior femora, 18–20 mm. Female about the same size; ovipositor, 25 mm.

Rather common from about the middle of July until October in damp fields amongst the tall grasses and weeds. It is also found in salt meadows. Its stridulation is very different from that of the other species of *Conocephalus*, being a continuous *ik-ik-ik-ik-ik-ik*, etc. Sings late in the afternoon and by night.

Conocephalus dissimilis *Serville.*

PLATE VII, FIGS. 3 AND 4.

Similar in shape to *C. ensiger*, but the cone is much shorter, broader, obtusely rounded at the apex, and not pointed and elongated as in *C. ensiger*. The wings and wing covers are also shorter.

Measurements.—Length of body, 23–28 mm.; posterior femora, 17–20 mm.; wing covers, 28–34 mm.; ovipositor of female, 34 mm.

Found during August and September in the same localities as the preceding species.

Orchelimum *Serville.*

Size small; face oblique; vertex with a blunt tubercle at the apex, and meeting a smaller and similar projection from beneath; antennæ very long, thread-like; first joint very stout and cylindrical; second joint considerably smaller; pronotum flat on top, lateral carina well rounded, lobes of sides almost parallel, then forming more or less of a triangle at the bottom. Wing cases of the male narrow, broad to about the middle, then suddenly but gradually narrowing; stridulating organ well developed. In the female the wing cases are of almost equal width ; cerci with a sharp tooth-like hook inside, directed inward ; ovipositor of female slightly curved, and terminating in a sharp point ; anterior pairs of tibiæ with a number of spines.

Orchelimum vulgare *Harris.*

PLATE VI, FIGS. 4 AND 5.

Shining, grass green, with a broad, more or less distinct stripe on the head and thorax and back of abdomen. The legs are testaceous or partly green. Antennæ twice as long as the body, testaceous. Wings extending beyond the tip of the abdomen.

Measurements.—Male: Length of body, 17–21 mm. ; Wing covers, 18–22 mm. ; posterior femora, 14–15 mm. Female: Length of body, 17–21 mm. ; wing covers, 15–20 mm. ; posterior femora, 15–17 mm.

Very abundant in this vicinity from about the middle of July until late in autumn. It is found in open fields, copses and along ditches, usually resting on leaves and stems of bushes and tall grasses. Dr. Scudder says : "When about to sing on a hot sunny day, the male mounts a stalk of grass about a foot from the ground, where it clings with its four front legs, allowing its hind legs to dangle on either side the stalk, that they may not interfere with the wing covers. Beginning with a *ts* it changes almost instantly into a trill of *zr*. At first there is a crescendo movement which reaches its volume in half a second ; the trill is then sustained for a period varying from one to twenty seconds, but generally from six to eight seconds, and closes abruptly with *p*. This strain is followed by a series of very short staccato notes sounding like *jip*, *jip*, *jip*, repeated at half-second intervals ; the staccato notes and trill alternate *ad libitum*. The staccato notes may be continued almost indefinitely, but are very rarely heard more than ten times in direct succession ; it ordinarily occurs three or four times before the repetition of the phrase, but not more than two or three times when the phrase is not repeated."

Orchelimum concinnum *Scudder.*

Green, with a broad, dark reddish brown longitudinal band along the middle of the thorax and head where the stripe narrows to the width of the tubercle on the vertex of the head, passing over this down the front to the mouth, expanding broadly in the middle of the face ; legs green or brownish green. Wing cover greenish brown, shorter than the hind wing in the male, and as long or nearly so in the female ; hind wings transparent, with dark veins ; ovipositor of female slightly curved.

Measurements.—Length of body, 18 mm. ; wing covers, 20 mm. ; hind femora, 16 mm. ; ovipositor, 8 mm. ; expanse, 44 mm.

Quite rare in this vicinity. It frequents damp and marshy localities and lowlands. Found from July to late in the fall. It may be readily separated from *O. vulgare* by its being a much more slender and graceful insect with narrower wing covers.

Orchelimum agile (*De Geer*).

Recorded from New Jersey and southward. Possibly will also be found in this vicinity.

Xiphidium *Serville.*

Very closely allied to the genus *Orchelimum*, from which it can hardly be separated. The species, however, are much smaller and more graceful, and the ovipositor of the female is straight instead of curved. Wings as long, longer, or shorter than the abdomen.

Xiphidium fasciatum (*De Geer*).

PLATE VI, FIG. 7.

Pale green, with a broad reddish brown longitudinal band on its thorax, running to the top of the head, where it is considerably narrower ; face entirely green ; abdomen above reddish, green beneath. Wing covers and wings extending much beyond the body, reaching the tip of the ovipositor in the female. Hind wings somewhat longer than the wing covers.

Measurements.—Length of body, 13.5 mm. ; wing covers, 17 mm. ; hind femora, 11 mm. ; ovipositor, 8 mm.

Common everywhere, in swampy meadows, from the latter part of June until late in the fall.

Xiphidium brevipennis *Scudder.*

PLATE VI, FIG. 6.

Smaller and somewhat stouter than *X. fasciatum*. Color light green or pale brown, with the band on the thorax and head the same as in *fasciatum*. Wings almost as long as the body, and not extending beyond as in *fasciatum*. The ovipositor is also longer. Antennæ about three times as long as the body.

Measurements.—Length of body, 9–12 mm.; wing covers, 6–8 mm.; posterior femora, 11–12 mm.; ovipositor, 9–12 mm.

Very common in damp fields overgrown with tall grass and weeds, but especially abundant in salt meadows. Found from the latter part of July until late in autumn.

Xiphidium nemorale *Scudder.*

Greenish brown; wing covers greenish with the front margin blackish, nearly as long as the abdomen in the male, somewhat shorter in the female; top of head and pronotum with a broad, very faint, reddish longitudinal stripe margined with a whitish line on each side; legs greenish with many red dots; wing covers with prominent cross-veins; ovipositor of female as long as the abdomen, slightly curved upwards apically.

Measurements.—Male: Length of body, 14 mm.; wing covers, 8 mm.; hind femora, 12 mm. Female: Length of body, 15 mm.; wing covers, 5.5 mm.; hind femora, 13 mm.; ovipositor, 9 mm.

This species may be found from about the middle of August until frost, resting on low shrubs and weeds along roadsides and the borders of dry upland woods. It is a western insect, and in this vicinity it occurs in New Jersey along the eastern slope of the Palisades.

Xiphidium nigripleurum *Bruner.*

Reported from Ithaca, N. Y., and may possibly be taken in this vicinity.

DECTICIDINÆ.

Atlanticus *Scudder.*

Head rounded; vertex compressed; pronotum flattened on top with the lateral carina sharp and abruptly bent down at the sides. The pronotum is narrower in front than behind, and slightly pinched before the middle; it also extends backwards over the first abdominal segment. Wing covers of female rudimentary and hidden under the pronotum; those of the male about half as long as the body; ovipositor of female stout at base, straight, flattened, and pointed obliquely upwards.

Atlanticus pachymerus (*Burmeister*).

PLATE VII, FIG. 7.

Grayish brown, with the wing covers of the male marked with black. The abdomen and femora are sprinkled with minute blackish dots. The extreme lateral edge of the pronotum with a yellowish border, preceded by a black streak at the posterior portion.

Measurements.—Male : Length of body, 20 mm. ; pronotum, 9 mm. ; wing covers, 8 mm.; posterior femora, 15 mm. Female somewhat larger ; ovipositor, 20 mm.

Rare in this vicinity. It occurs in dry places, especially along hill sides. Found from about the middle of June until late in September.

Atlanticus dorsalis (*Burmeister*).

PLATE VII, FIG. 8.

Closely allied to the preceding species, but may be distinguished from it by being larger, and the legs and ovipositor considerably longer. The color is much the same as in *A. pachymerus.*

Measurements.—Length of body, 24 mm. ; pronotum, 10 mm.; posterior femora, 25 mm.; ovipositor, 30 mm.

Found in similar localities as the preceding species. Very rare.

STENOPELMATINÆ.

Ceuthophilus *Scudder.*

Wingless ; head large, oval, vertex not tuberculate ; last joint of palpi longer than the third, and grooved beneath at the apex ; antennæ very long, usually two or more times as long as the body ; pronotum not extending over the meta- and mesothorax as in *Atlanticus*, and well rounded on top ; abdomen arched ; legs long, slender, with a few spines ; hind femora swollen at the base, channelled beneath, and more or less spined ; hind tibia with more than four pairs of spurs, first tarsal joint almost as long as the rest together ; ovipositor of female straight, more or less swollen at the base.

The members of this genus live in dark, damp places in cavities, under stones, mole hills, and in cellars.

Ceuthophilus gracilipes *Scudder.*

Ground color of body varying from luteous to dark castaneous, very heavily marked with black, so that the latter is often or perhaps generally the prevailing tint ; the dark colors prevail always on the hinder half of all the segments. The black markings are irregular and much broken ; outer sides of the posterior femora with blackish transverse streaks, more or less distinct. Antennæ about three to four times as long as the body. Legs very long. Hind femora as long or longer than the body, stout at base and about twice the length of the fore femora ; outer carina of the hind femora of the male with about thirteen coarse spines ; inner carina with the spines considerably shorter and more even ; in the female the carina are almost unarmed ; hind tibiæ longer than the femora, straight or slightly waved.

Measurements.—Male : Length of body, 19–22 mm.; antennæ about 75 mm.; pronotum, 5.75 mm.; fore femora, 10 mm.; hind femora, 20 mm. ; hind tibiæ, 24.75 mm. Female slightly larger ; ovipositor, 15.5 mm.

Found during July and August in dark cellars of houses and barns, in hollow places under stones, and in hollow trees. It is one of the largest of the species of *Ceuthophilus* found in this vicinity.

Ceuthophilus grandis *Scudder.*

PLATE V, FIG. 17.

Allied to the preceding species ; in color and markings it is almost the same, but differs from it in having the pronotum and legs somewhat longer ; the hind femora are also longer and more robust.

Measurements.—Male : Length of body, 19 mm. ; pronotum, 6.5 mm. ; antennæ, 90 mm. ; fore femora, 11 mm. ; hind femora, 22 mm. ; hind tibia, 25 mm. Female somewhat larger ; ovipositor, 13.5 mm.

This insect has been taken at West Farms, New York City ; heretofore it was only known from Tennessee. It is closely related to *C. gracilipes*, but is a heavier insect and the spines on the hind femora of the male are longer.

Ceuthophilus uhleri *Scudder.*

Reddish brown or rufo-testaceous, heavily flecked with dark fuscous so as to produce a tolerably uniform mottled appearance ; on the pronotum is a pale medio-dorsal streak ; the flecking is made up of small more or less confluent dots ; legs luteous more or less infuscated, especially the apical portion of the femora and the markings of the hind femora ; antennæ about twice as long as the body ; fore femora less than half as long as the hind femora, about one-third longer than the pronotum, and about one-fourth longer in the female ; hind femora stout, about three and a third times as long as broad, with the outer portion of the apical half and upper portion of the inner side with scabrous raised points, the outer carina armed with 7–8 unequal inequidistant coarse irregular spines, or almost unarmed but for some 3–4 raised points in the female, the inner carina with about 16 small spines or only a few slight ones on the apical fourth in the female ; hind tibiæ longer than the femora.

Measurements.—Male : Length of body, 15 mm.; pronotum, 5 mm.; hind femora, 17.75 mm.; hind tibiæ, 18.5 mm.; fore femora, 7.35 mm. Female : Length of body, 15 mm.; pronotum, 4.6 mm.; hind femora, 13 mm.; hind tibiæ, 18.5 mm.; fore femora, 5.75 mm. ; ovipositor, 8.25 mm.

Rather scarce, living under stones.

Ceuthophilus neglectus *Scudder.*

Castaneous, more or less infuscated, especially above sides luteous ; a broad more or less and often very obscure mediodorsal rufo-luteous stripe on the pronotum, sometimes extended farther back but then generally broken ; the side of the pronotum and to a lesser extent the meso- and metathorax are more or less blotched with luteous, and the abdomen is more or less but generally feebly maculated with luteous ; the legs are generally luteo-castaneous, the tips of all the femora dark, sometimes almost black, the hind femora with scalariform fuscous markings ; antennæ two to three times as long as the body ; the legs are rather slender and moderately short ; fore femora much less than half as long as the hind femora and but little longer than the pronotum ; hind femora stout, the upper and lower margins almost equally arcuate, almost three times as long as broad, the inner surface with a few raised points next or at the upper margin beyond the middle, scarcely visible or absent in the female ; both carina minutely, closely and uniformly serrulate, through all but the basal third, the inner carina a feebler repetition of the outer. In the female the serrulations are sometimes almost imperceptible ; hind tibæ scarcely as long or not longer than the femora. Ovipositor half as long as the hind tibiæ.

Measurements.—Male : Length of body, 12.5 mm.; pronotum, 4.4 mm.; fore femora, 5 mm.; hind femora, 12 mm.; hind tibiæ, 12 mm. Female about the same size ; ovipositor, 6 mm.

This is one of the smallest species of *Ceuthophilus* found in this vicinity. It is not common.

Ceuthophilus maculatus (*Harris*).

Glabrous, mottled with luteous and blackish, the darker markings predominating ; on the pronotum a luteous, mediodorsal stripe, also traces of such a stripe along the dorsum of the meta- and mesothorax ; the hind femora are strongly infuscated outside and inside ; the anterior pairs of femora infuscated at the apex and all the tibiæ at the base; posterior tibiæ infuscated along the upper side; fore femora a little more than a fourth longer than the pronotum, and much less than half as long as the hind femora; hind femora as long as the body, three and a half times as long as broad, moderately stout at base, and with no raised points on the upper or inner surface, outer carina with about thirteen unequal coarse spines in the male, and minute distant inconspicuous spinules in the female; inner carina with similar but uniform spines, none so large as on the outer carina (male) or with a few minute spinules on the apical half (female), the intervening sulcus not very broad. Hind tibiæ feebly undulate in the basal half in the male. Ovipositor nearly two-thirds as long as the hind femora.

Measurements.—Male: Length of body, 14 mm.; pronotum, 5 mm.; fore femora, 6.6 mm.; hind femora, 15.25 mm.; hind tibiæ, 16.25 mm. Female slightly larger; ovipositor, 10 mm.

Found in woods under stones, in hollow trees and under loose bark.

Ceuthophilus terrestris *Scudder.*

Recorded from northern New York, the New England States and Maryland, and will doubtless also be found in this vicinity.

Ceuthophilus lapidicolus (*Burmeister*).

Recorded from Pennsylvania and southward; may be found in this vicinity.

Ceuthophilus blatchleyi *Scudder.*

Recorded from New York, and possibly will also be found in this neighborhood. It is closely allied to *C. uhleri*, but differs by having slightly different and weaker armature of the carina of the hind femora, by the slenderer hind femora, and the narrower inferior sulcus of the same.

Ceuthophilus latens *Scudder.*

Recorded from Ithaca and Endfield Falls, N. Y., and southwestward to Texas. It will possibly be found also in this vicinity.

Synopsis of Species of Locustidæ.

Scudderia.

Wing covers long and narrow, grass green.
  Anal segment of male with one decurved spine above and one recurved spine below; ovipositor curved upwards.
    Notch of supra-anal spine square, with a minute median tooth; sides of notch slender and compressed at tip...... *S. curvicauda.*
    Notch of supra-anal spine acute; sides of notch rounded, lower margin thinner.............................. *S. furculata.*
  Notch of supra-anal spine very deep and rounded, with the sides much swollen, forming a thick, fork-like process.
    Grass green; length of hind femora, 19–20 mm...... *S. angustifolia.*
    Grass green; length of hind femora, 22–23 mm.......... *S. furcata.*
    Wing covers with black streaks; hind femora 17–18 mm., *S. fasciata.*
Wing covers broad; stridulating organ large; pronotum almost as broad as long on top.
  Supra-anal spine of male similar to that of *furculata*, but not compressed at the apex............................ *S. pistillata.*
  Supra-anal plate of male truncate, spine absent.............. *S. truncata.*

Amblycorypha.

Wing covers oblong broad, somewhat expanded in the middle and well rounded at the apex.
  Supra-anal plate truncate; subanal plate furcate, with two short spines; ovipositor of female long, recurved.
    Hind femora reaching the tip of the wing covers.... *A. rotundifolia.*
    Hind femora shorter, not reaching the tip of the wing covers, *A. oblongifolia.*

Microcentrum.

Wing covers broad in the middle, tapering suddenly towards the apex; ovipositor very short, recurved.
  Hind femora short, about half as long as the wing covers, *M. laurifolium.*

Cyrtophyllus.

Wing covers very broad and concave.
  Legs stout; subanal plate of male elongated, paddle-like; ovipositor of female recurved, long............................ *C. concavus.*

Conocephalus.

Head with a cone-like projection; wing covers narrow; ovipositor very long and straight.
  Cone of head long, bluntly pointed, with a slight touch of black at the apex.................................. *C. robustus.*
  Cone of head very long, rather sharply pointed, black beneath to about the middle.......................... *C. exiliscanorus.*
  Smaller species: Cone of head pointed, bordered beneath with black from about the middle to the apex................... *C. ensiger.*
  Cone of head broad, not pointed, obtusely rounded at apex.. *C. dissimilis.*

Orchelimum.

Pronotum with lateral carina rounded; vertex with blunt tubercle; ovipositor slightly curved.
  With broad brown stripe on top of head and pronotum........ *O. vulgare.*
  With broad stripe on face, top of head and pronotum...... *O. concinnum.*

Xiphidium.

Small species, more slender and graceful than *Orchelimum*; ovipositor straight.

Wings and wing covers extending beyond the abdomen.
  Green ; with a broad reddish brown stripe on top of the head and pronotum.................................. *X. fasciatum.*
Wings and wing covers shorter than the abdomen.
  Green ; with a broad reddish brown stripe on the top of head and pronotum .. ..*X. brevipennis.*
  Greenish brown, stripe on head indistinct, margined by two white lines ; legs with small red dots..............*X. nemorale.*

Atlanticus.

Pronotum extending over the first abdominal segment ; male with short wing covers , female wingless.
  Legs long ; hind femora 27 mm.; ovipositor 30 mm. long.....*A. dorsalis.*
  Legs shorter; hind femora 22 mm.; ovipositor 20 mm. long, *A. pachymerus.*

Ceuthophilus.

Body stout ; arcuate above, wingless.
  Large size : Legs very long ; fore femora of male from one-half to two-thirds as long again as the pronotum.
    Hind femora of male much less than four times as long as broad ; hind tibiæ very long, sometimes sinuous at base, *C. gracilipes.*
    Hind femora of male much more than four times as long as broad ; hind tibiæ scarcely longer than the hind femora, *C. grandis.*
  Medium size : Legs shorter ; fore femora but little longer, if any, than the pronotum ; hind tibia waved.
    Hind femora of male three and a half times as long as broad ; no large spines on the outer carina ....*C. maculatus.*
  Small species : fore femora a little longer than the pronotum.
    Hind femora stout ; outer carina of male with minute spines, *C. neglectus.*

ACRIDIDÆ.—Locusts.

The members of this family found in this vicinity are divided into four sub-families, which may be characterized as follows :

Prosternum smooth or with an indistinct tubercle ; hind angle of pronotum truncate or nearly so.
  Head more or less pyramidal, face oblique,antennæ flattened, Truxalinæ.
Prosternum entirely smooth.
  Hind margin of pronotum acute-angled... .... Œdipodinæ.
Prosternum with a long tubercle.
  Hind margin of pronotum obtusely angled................Acrididinæ.
Pronotum extending back over the abdomen to its extremity or beyond it ; very small species.
  Wing covers rudimentary................. ....Tettiginæ.

TRUXALINÆ.

Truxalis *Linnæus.*

Head slightly ascending on top ; vertex projecting, horizontal and rounded in front. Face very oblique, with the median carina sulcate, lateral carina straight, more or less distinct, reaching the corners of the face; eyes oblong, oblique, and placed well forward; antennæ about as long as the head, flattened at the base and rounded towards the tip; pronotum twice as long as broad, sides perpendicular, flat and almost parallel; top of pronotum flat with lateral and median carina, and three indistinct transverse incisions; wing covers long and narrow, obliquely truncate at apex; prosternum smooth; all the wings extend somewhat beyond the posterior femora, which are flattened and longer than the tibiæ. The male is similar to the female, but is very much smaller.

Truxalis brevicornis *Linnæus.*

PLATE VIII, FIGS. 1 AND 2.

Pale green, somewhat dotted with brown over the wing covers; lateral carina of pronotum and antennæ and edge of vertex brown; mouth parts and front legs pinkish brown. Hind wings transparent, with the veins greenish. The male is usually entirely pinkish brown, with the fore wings much paler along the inner margin. Some individuals have the top of head, face, the two front pairs of legs and the inner margin of the fore wings green. Hind wings dusky, greenish at the base.

Measurements.—Male: Length of body, 19–21 mm.; wing covers, 19–20 mm.; posterior femora, 12–13 mm.; expanse, 39–43 mm. Female: Length of body, 35 mm.; wing covers, 31 mm.; posterior femora, 20 mm.; expanse, 63 mm.

Rare in this neighborhood. It is found during August and in early September in damp or swampy places overgrown with grass and weeds. The insect is local in habit.

Opomala *Serville.*

Head pyramidal, and very large in the female, and much longer than the pronotum, face very oblique, antennæ flattened, enlarged at the base; top of head with a distinct median carina in the female and less distinct in the male; prosternum with a minute tubercle; pronotum twice as long as wide, sides perpendicular, top parallel truncate in front and behind, carina somewhat indistinct; wing covers lanceolate, reaching a little beyond the middle of the abdomen in the male, shorter in the female; hind wings abbreviated; hind legs slender, femora reaching the tip of the abdomen. The male is considerably smaller and more graceful than the female.

Opomala brachyptera *Scudder.*

Light brown, sometimes streaked with dark brown; knees of hind legs black; wing covers much shorter than the abdomen.

Measurements.—Male: Length of body, 23 mm.; wing covers, 10 mm.; posterior femora, 12 mm. Female: Length of body, 28 mm.; wing covers, 8 mm.; posterior femora, 12 mm.

Very rare in this vicinity. Found during July. In general appearance the female of this insect very much resembles the pupa of *Truxalis brevicornis.*

Syrbula admirabilis (*Uhler*).

This species was described from Maryland, and has also been recorded from New Jersey, but at present we have no knowledge of its occurrence in this vicinity.

Chloëaltis *Harris.*

Female: Top of head rounded, vertex produced into a short, blunt pyramid; face oblique, with the median carina broad, slightly sulcate, and a rather sharp lateral carina; eyes large, extended forward, and pointed at the apex; pronotum parallel with three carina; sides perpendicular, compressed; wing covers half as long as the abdomen; hind wings somewhat shorter. The wings in the var. *punctulata* are as long as the abdomen. The male is much smaller, with the face more oblique, and the wings nearly reaching the tip of the abdomen.

Chloëaltis viridis *Scudder.*

Plate VII, Fig. 10.

Female grass green or dirty brown, with a blackish line beginning behind the eye and running along the lateral carina of the pronotum. Hind tibiæ brown. The male is green on top of the head and pronotum, upper half of wing cases and middle pair of legs; face pale yellowish brown, remaining parts dirty brown. Hind wings smoky in both sexes.

Measurements.—Male: Length of body, 16 mm.; wing cases, 8 mm.; posterior femora, 10 mm. Female: Length of body, 25 mm.; wing covers, 9 mm.; posterior femora, 14 mm.

Very common from the latter part of July until late in the fall, in dry grassy fields, meadows and hillsides.

Chloëaltis viridis var. punctulata *Scudder.*

Differs from the preceding by having the wings extending to the tip of the abdomen. Wing covers green and marked with scattered, small blackish-brown spots. Hind wings smoky and about as long as the wing covers.

Found in the same localities as *C. viridis*, but is quite rare in this vicinity.

Chloëaltis conspersa *Harris.*

PLATE VII, FIG. 9, MALE.

Wholly dirty brown with minute darker brown dots, except the underside of abdomen orange yellow and the posterior tibiæ red; hind femora with one or two rather large light brown patches outside. Wings about half as long as the abdomen. The male is much narrower than the female; the wing covers are broad and extend nearly to the tip of the abdomen; hind wing very small; the antennæ are considerably longer than those of the female. In color it is yellowish brown; sides of pronotum glossy black, as are also the first few abdominal segments; hind femora with two light-colored spots outside; hind tibiæ red, black at base and apex.

Measurements.—Male: Length of body, 20 mm.; wing covers, 10 mm.; posterior femora, 13 mm. Female: Length of body, 23 mm.; wing covers, 7 mm.; posterior femora, 13 mm.

Found in dry grassy places on hillsides, fields, and in open woods, during the latter part of July until October. Not common. It may be easily recognized by the light-colored spots on the outside of the posterior femora, and red hind tibiæ.

Stenobothrus *Fischer.*

Body elongate, rather narrow. Face oblique with the carina as in *Chloëaltis*, as also the vertex. Pronotum more or less constricted about the middle, with the three carina usually distinct; wing covers narrow, as long, longer or shorter than the abdomen.

This genus is closely allied to *Chloëaltis*, but may be distinguished from it by the constricted pronotum, and the narrower and more elongate body.

Stenobothrus maculipennis *Scudder.*

PLATE VIII, FIG. 4.

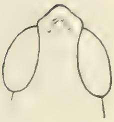


FIG. 7.
Head of *S. maculipennis.*
(Female.)

Head and pronotum green or brown, or pinkish brown with black markings; on each side of the pronotum is a velvety-black stripe, broken in the middle by the lateral carina, which are whitish or pinkish. Wing covers narrow, and extending beyond the abdomen, green or brown with a row of square spots along the middle and scattered over the outer portion; hind wings almost as long as the wing covers. Legs green or brown, hind femora sometimes with a reddish tinge.

Measurements.—Female: Length of body about 20 mm.; wing covers, 18 mm.; posterior femora, 12 mm.; pronotum, 3 mm. Male: Length of body, 16 mm.; wing covers, 14 mm.; posterior femora, 9 mm.; pronotum, 2.5 mm.

Common in dry grassy places, especially on sandy soil. Found during July until October. It is somewhat variable in color, some individuals being wholly green or brown, or any mixture of the two, but green males are the least common of any of the forms. Some specimens show considerable rose-red, or may be very largely blackish fuscous throughout.

Stenobothrus olivaceus *Morse.*

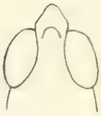


Fig. 8. Head of *S. olivaceus.* (Male.)

Closely allied to *S. maculipennis*, but differs in having the vertex more nearly horizontal, more acute, more angulate with the front in profile; more narrowed between the eyes. The face is more oblique; the antennæ are shorter, more flattened toward the base and more finely pointed. The pronotum is longer and less constricted, thus making the space between the lateral carina broader, and the carina in straight lines rather than curves. In color it varies from brown to olivaceous. Size same as that of *S. maculipennis.*

Has been taken at Stamford and Greenwich, Conn.; also at Sandy Hook, N. J. It is found during August and September in salt marshes near the seashore. It will probably also be found on Long Island and at other places in this vicinity.

Stenobothrus æqualis *Scudder.*

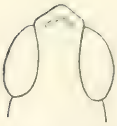


Fig. 9. Head of *S. æqualis.* (Female.)

Resembles *S. maculipennis* and *S. olivaceus*, from which it may be distinguished by the shorter and blunt vertex; the disk of the anterior portion of the pronotum is broader and the wing covers only extend to the tip of the abdomen. It is also somewhat smaller. The variety *bilineatus* has two broad black bands running from behind the eyes, inside the lateral carina, to the end of the pronotum.

Common everywhere in this vicinity in dry places covered with short, stubby grass. It is also variously colored, being either green or brown, or both. The males are rarely green.

Stenobothrus curtipennis (*Harris*).

Head and thorax pale yellowish brown, olive gray or dirty grass green; wing covers light or dark yellowish brown; underside of body bright yellow; legs yellowish ; hind femora black at apex ; hind tibia black at the knee, rest pale reddish or yellow ; behind the eyes is a shining black stripe, which extends to the end of the pronotum ; this stripe is usually more or less distinct, but sometimes almost absent ; antennæ black-brown at the base, sometimes wholly black ; wing covers shorter than the abdomen. In the variety *longipennis* the wings are as long or longer than the abdomen.

Measurements.—Male : Length of body, about 15 mm.; wing covers, 9–15 mm.; posterior femora, 11 mm.; antennæ, 10 mm. Female : Length of body, 20–25 mm. ; wing covers, 9–15 mm. ; posterior femora, 13 mm. ; antennæ, 7 mm.

Found from the latter part of July until October, in swampy meadows. Rather common.

ŒDIPODINÆ.

Chortophaga *Saussure.*

Body compressed ; legs remote ; antennæ somewhat flattened, short ; pronotum acutely angled behind, median carina elevated into a keel-shaped ridge ; sides almost parallel.

Chortophaga viridifasciata (*De Geer*).

PLATE VIII, FIG. 9.

Head and thorax bright green ; abdomen yellowish green ; hind femora green with black bands inside ; hind tarsi lead color with a white band near the base ; wing covers wholly green or green along the costal margin to beyond the middle with the remaining part semi-transparent, dusky ; hind wings transparent, yellowish green at base, smoky towards the outer portion ; antennæ reddish.

Measurements.—Male : Length of body, 21 mm. ; wing covers, 20 mm. ; hind femora, 12 mm. Female : Length of body, 25 mm.; wing covers, 22 mm.; hind femora, 14 mm.

Chortophaga viridifasciata var. **infuscata** (*Harris*).

In this variety the head, thorax and wing covers are dusky brown, the latter with a few darker patches. The hind femora are pale brown and whitish inside with black bands. The hind wings and hind tarsi are the same color as in the preceding form. Size also the same.

Found everywhere in this vicinity in open pastures from the latter part of April until frost. Double brooded. The variety *infuscata* is less abundant, but more common in the South.

Encoptolophus *Scudder.*

Head somewhat swollen, cheeks and face rounded, the latter with the median carina sulcate, lateral carina distinct ; vertex broad, somewhat concave, triangular in front ; pronotum pinched at the sides ; median carina elevated, distinct, and cut in the middle by a distinct notch ; lateral carina indistinct ; hind angle triangular ; wing covers of equal width except at the base ; hind wings broad and almost as long as the wing covers ; both reaching a little beyond the abdomen ; hind femora rather flat and broad.

Encoptolophus sordidus (*Burmeister*).

Plate X, Fig. 2.

Dusky brown, varied with lighter and darker shades ; pronotum with a pinkish buff X-shaped mark on top ; hind femora with blackish and buff-colored bands ; hind tibiæ blackish with a sordid white band near the base ; wing covers fuscous, semitransparent, with two distinct pale transverse fasciæ, and other small pale spots scattered over the wings ; hind wings transparent, yellowish at base and the outer portion smoky.

Measurements.—Male : Length of body, about 19 mm. ; wing covers, 19 mm. ; hind femora, 13 mm. Female : Length of body, 28 mm. ; wing covers, 24 mm. ; hind femora, 15 mm.

Common everywhere in this neighborhood in pastures and gardens. It occurs during the months of September and October.

Camnula pellucida *Scudder.*

Occurs in Connecticut and northward, and probably also may be found in this vicinity.

Arphia *Stål.*

Head large ; pronotum keel-shaped, arcuate, granulated, notched or entire, and more or less angled behind ; lateral carina wanting ; wing covers long and narrow ; hind wings broad ; hind femora compressed and dilated.

Arphia sulphurea (*Fabricius*).

Plate VIII, Fig. 10.

Vertex of head triangular in front ; pronotum obtusely angled in front and behind ; median carina prominent, slightly curved ; head, thorax, wing covers, abdomen and legs dark brown ; hind femora outside also dark brown, inside black with white bands ; hind tarsi black, or sometimes blackish lead color.

with a white band near the base ; hind wings yellow on basal half, outer part blackish, with dash of the same color below the costa, running for some distance in the yellow color.

Measurements.—Male : Length of body, 20 mm. ; wing covers, 21 mm.; hind femora, 13 mm. Female : Length of body, 30 mm. ; wing covers, 24 mm.; hind femora, 15 mm.

Found from about the middle of May until the middle of July in dry, open grassy places.

Arphia xanthoptera (*Burmeister*).

PLATE VIII, FIG. 11.

Closely allied to *A. sulphurea*, but is a larger and heavier insect. The pronotum is acute in front and very acutely pointed behind ; the median carina is keel-shaped and arched. In color and markings it is similar to the preceding species.

Measurements.—Male : Length of body, 24 mm.; wing covers, 25 mm.; posterior femora, 15 mm. Female : Length of body, 32 mm.; wing covers, 29 mm.; posterior femora, 18 mm.

Occurs in similar localities as *A. sulphurea*, but especially on dry sandy places and hillsides. Found during the latter part of August and until the latter part of September.

Hippiscus *Saussure.*

Form robust ; pronotum granulate, median carina distinct and slightly notched before the middle ; sides of pronotum somewhat compressed in the middle and above on each side of the carina ; truncate in front and acute angled behind, vertex flattened and continuous with the median carina of the face ; wings extending beyond the abdomen.

Hippiscus tuberculatus (*Pal. de Beauv.*).

PLATE X, FIG. 3.

Ashy lead color, darker above, abdomen beneath yellowish brown ; antennæ ochreous at base, piceous toward the apex ; head uniform in color ; pronotum with a dark brown streak along the middle of the lateral lobes ; posterior edge of pronotum ochreous ; wing covers like the body in color, with fuscous blotches and with the axillary fold yellowish brown ; hind wings coral red at the base, with an arcuate blackish band and the apex nearly transparent ; hind femora ashen brown with two blackish dashes more or less distinct, inside black or prussian blue at base, then ochreous with a black or blue band ; hind tibiæ ochre yellow.

Measurements.—Male: Length of body, 25–30 mm.; wing covers, 25–30 mm.; hind femora, 15–17 mm. Female: Length of body, 40 mm.; wing covers, 33 mm.; hind femora, 21 mm.

This species makes its appearance early in May and is found until July. It occurs in dry pastures or open fields covered with a growth of low bushes.

Hippiscus phœnicopterus (*Germar*).

PLATE IX, FIG. 4.

Head ashen gray with darker shades; pronotum grayish brown tinged with olive green, with a more or less distinct angular band on each side; abdomen pale ochre yellow; wing covers marked with large black spots, apex semitransparent with the spots smaller; hind wings at base deep orange red, outside of this and just beyond the middle the wings are crossed by a curved black band, running from the costa to the anal angle, apex transparent; hind femora yellowish brown with three indistinct bands, inside deep blue and with a yellow ring near the apex; hind tibiæ yellowish, tinged with orange in some specimens.

Measurements.—Male: Length of body, 30 mm.; wing covers, 30 mm.; posterior femora, 17 mm. Female: Length of body, 43 mm.; wing covers, 39 mm.; posterior femora, 21 mm.

Very rare in this vicinity, but more common in the Southern States. It is found during June and July in dry pastures and waste places.

Hippiscus rugosus (*Scudder*).

Recorded from the New England States, and may possibly also be found in this vicinity. The basal portion of the hind wings are yellow instead of red, as in the two preceding species.

Dissosteira *Scudder.*

Size large; head prominent; median carina of the pronotum high, compressed and notched near the middle, arched on the posterior lobe and almost straight on the anterior lobes; wings and wing covers extending about one-third their length beyond the abdomen.

Dissosteira carolina (*Linnæus*).

PLATE X, FIG. 6.

Varies in color from almost sepia brown to rusty brown, with small dusky dots; wing covers more or less covered with spots; hind wings black with a pale yellow outer border, dusky at the apex with a few black spots ; hind femora whitish inside, black at base to about the middle, apex black and a black band between ; hind tibia dirty white with a more or less distinct black and white annulus at the base.

Measurements.—Male : Length of body, 27 mm. ; wing covers, 30 mm. ; posterior femora, 14 mm. Female : Length of body, 35–37 mm.; wing covers, 40 mm.; posterior femora, 18 mm.

This is one of the most common Grasshoppers we have in this vicinity. It is found everywhere, in open fields, meadows and dusty roads, and often seen in the city streets. It is distributed from the Atlantic to the Pacific coasts.

Trimerotropis *Stål.*

Vertex continuous with the median sulcus of the face ; body covered with very short hairs ; pronotum compressed before the middle, narrower in front than behind ; slightly angled in front and acutely angled behind ; median carina slight and broken by two wide notches before the middle ; lateral carina distinct on the posterior lobe and broken on the anterior lobes ; wing covers long and narrow ; hind wings narrowing to a point at the apex.

Trimerotropis maritima (*Harris*).

PLATE X, FIG. 5.

Head, pronotum, legs and posterior femora white, sprinkled with minute atoms and dots of black and brown; eyes ochraceous; inside of hind femora with two black spots ; hind tibiæ light yellow, spines tipped with black ; wing covers also whitish, sprinkled more or less with black and brown atoms and spots, apex transparent ; hind wings at base semi-transparent, pale yellow followed by an arcuate, narrow black band, more or less broken by the veins, outer third of wing transparent.

Measurements.—Male : Length of body, 23 mm. ; wing covers, 24 mm. ; posterior femora, 13 mm. Female : Length of body, 32 mm. ; wing covers, 33 mm. ; posterior femora, 16 mm.

Very common on the seashores of Long Island, Staten Island and New Jersey. The insect may be readily known by its white color. Found from the latter part of July until about the middle of September.

Spharagemon *Scudder.*

Body pubescent ; top of head somewhat swollen ; vertex broad, tapering rapidly, and continuous with the median sulcus of the face ; pronotum compressed before the middle, disk somewhat flattened ; more or less acutely angled behind ; median carina compressed, more or less keel-shaped, and divided by a deep furrow, the front portion being a little shorter ; lateral carina almost obsolete. Wings extending beyond the tip of the abdomen ; wing covers almost of equal width throughout ; hind wings subtriangular.

Spharagemon bollii *Scudder.*

PLATE X, FIG. 1.

Brownish fuscous, somewhat variable in color ; face grayish, with minute blackish dots ; hind femora grayish or brown, pale dirty yellow inside with black bands, which are indistinct outside ; hind tibiæ coral red, black at base, and followed by a dirty white and black band occupying almost half the tibiæ ; wing covers earthen-brown with many darker minute spots, and three more or less distinct blackish brown transverse fasciæ ; hind wings pale yellow at base, with a median, arcuate black band ; outer portion of the wing transparent, sometimes dusky at the apex, especially in the male.

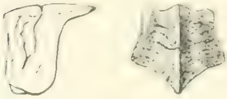


FIG. 10. FIG. 11.
Side and top of pronotum of *S. bollii.*

Measurements.—Male : Length of body, 20–22 mm. ; wing covers, 22–25 mm.; posterior femora, 12.5–13.5 mm. Female : Length of body, 27–33 mm.; wing covers, 23–28 mm.; posterior femora, 12.5–17 mm.

This species is found on dry sandy soil, in pastures, near the edges of woods, and on almost any ground of barren character. It is of local distribution, and occurs from the latter part of July until late in October.

Spharagemon saxatile *Morse.*

Pronotum stout, slightly compressed anteriorly, broad posteriorly ; front margin of disk slightly angulated, hind margin right angled, the apex blunt ; median carina low, severed before the middle by a vertical incision, the anterior portion of the carina being higher than the posterior half. Body stout and less compressed than in *S. bollii* ; blackish fuscous in spots and bands on an ash-gray ground color, abdomen somewhat yellowish ; pronotum with an ash-gray X-shaped mark on the disk ; hind femora ash gray and sprinkled with black outside, yellowish inside with four transverse black bands, which are less

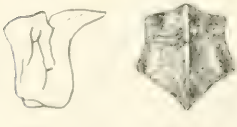


FIG. 12. FIG. 13.
Side and top of pronotum of *S. saxatile.*

distinct outside ; hind tibiæ coral red, black at base, followed by a whitish annulus ; wing covers ashen gray sprinkled with black and with three rather broad blackish bands ; hind wings sulphur yellow at base, followed by an arcuate median black band ; apical third of wings transparent, apex more (male) or less (female) fuscous.

Measurements.—Male : Length of body, 20–24 mm.; wing covers, 21.5–25.5 mm.; posterior femora, 11–14 mm. Female : Length of body, 32–39 mm.; wing covers, 25–31 mm.; posterior femora, 14–17 mm.

This species has been taken at Greenwich and New Haven, Connecticut, and at New Foundland, New Jersey. The insect is found in unsettled, somewhat wooded districts of a rocky, often elevated character. The color of the insect so harmonizes with the tints of the lichen-covered rocks that it is quite difficult to distinguish it when at rest. It is allied to *S. bollii* and *æquale*, but differs in shape of the median carina and hind angles of the pronotum. In color it very much resembles *Circotettix verruculatus*, which is found in similar haunts.

Spharagemon æquale (*Say*).

PLATE IX, FIG. 5.

Pronotum with median carina high and strongly compressed on the posterior lobe with a deep oblique incision, the dorsal edge of the carina arched on both lobes ; front margin of pronotum angulate, hind margin acute, sharp pointed, and excavate at the sides ; head, thorax and wing covers light rusty brown, granulated and spotted with lighter brown flecks ; hind femora with four transverse bands more or less distinct ; disk of pronotum sometimes with a paler indistinct X-shaped mark ; hind tibiæ coral red sprinkled with fuscous at the base, and sometimes with indications of a pale annulus near the base ; hind wings pale yellow at base, followed by a black arcuate band reaching the anal angle.

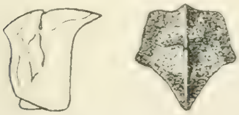


FIG. 14. FIG. 15.
Side and top of pronotum of *S. æquale.*

Measurements.—Male : Length of body, 21–23 mm.; wing covers, 23–24.5 mm.; posterior femora, 13–14 mm. Female : Length of body, 27–29 mm.; wing covers, 25.5–28.5 mm.; posterior femora, 14–16.5 mm.

This species may be found in open fields, on sandy soil, from about the middle of July until October. Very rare and local in this vicinity, but not rare, locally, in the sandy districts of Staten Island, New Jersey and Connecticut.

Circotettix *Scudder.*

Eyes somewhat prominent ; vertex channelled, and continuous with the median sulcus of the face ; head somewhat broader than the anterior lobes of the pronotum ; posterior lobe of pronotum broader and acute angled behind ; median carina slightly elevated, with two rather deep notches before the middle ; lateral carina indistinct on the posterior lobe, but not prominent. Wings and wing covers longer than the body ; the latter are of equal width throughout, with the apex oblique ; the former are rather broad.

Circotettix verruculatus (*Kirby*).

Plate IX, Fig. 6.

Ash gray, heavily mottled with black and gray ; sometimes the black almost obscuring the entire head, thorax and wing cases, thus giving the insect a very black appearance ; abdomen black ; hind femora with four more or less distinct black bands ; hind tibiæ yellowish with a black band at the base, a broader one at the extremity and one before the middle ; hind wings semitransparent, light yellow at the base and followed by a narrow, black, arcuate band ; apex transparent tipped with black ; sometimes the transparent space is black, but of a lighter shade than the band.

Measurements.—Male : Length of body, 22 mm. ; wing covers, 24 mm. ; posterior femora, 11 mm. Female : Length of body, 30 mm.; wing covers, 28 mm.; posterior femora, 13 mm.

This is a mountain insect, and it mimics the dark gray rocks covered with lichens. The nearest locality for the occurrence of the insect in this vicinity, as far as we are aware, is Delaware Water Gap, but it is not unlikely that it will also be found in the mountainous districts of New Jersey, nearer by. August and September. It is common in the mountains of New York, in New England, and westward. When flying, it produces a clicking noise.

Psinidia *Stål.*

Head large ; antennæ flattened ; pronotum granulated, acute angled behind, very much compressed before the middle ; median carina distinct with two notches ; lateral carina distinct on posterior lobe, broken on the anterior lobes ; wing covers narrow, hind wings broad, both extending beyond the body.

Psinidia fenestralis (*Serville*).

PLATE VIII, FIG. 3.

Ash colored, variegated with gray and dark brown ; body beneath yellowish buff ; hind femora grayish outside, black at base inside, a band beyond the middle and black at the apex, these bands are repeated outside ; hind tibiæ whitish, with a black ring at each end, and one of the same color before the middle ; wing covers ashen gray, variegated with brown and black, transparent at the apex ; hind wings pinkish red, salmon color or pale orange yellow at the base, then a rather broad arcuate smoky black band ; apex transparent in the female, more or less tipped with black in the male, the dark color usually connecting with the black band and enclosing a transparent patch.

Measurements.—Male : Length of body, 15 mm.; wing covers, 19 mm.; posterior femora, 10 mm. Female : Length of body about 25 mm.; wing covers, 23 mm.; posterior femora, 13 mm.

Common near the sea beaches of Long Island, Staten Island, New Jersey and Connecticut, from the latter part of July until October.

Scirtettica *Bruner*.

Allied to the genus *Psinidia*, but differs in having the pronotum less elevated and with a single notch in the middle ; the pronotum is also less acute angled behind. The hind wings are broader and more rounded.

Scirtettica marmorata (*Harris*).

PLATE X, FIG. 4.

Head and pronotum ashen gray, mottled more or less with darker markings, the pronotum sometimes with a pale, more or less distinct X-shaped mark on the disc ; hind femora gray with three black bands ; yellowish inside with the bands repeated ; hind tibiæ coral red with a blackish ring at the base, and followed by a whitish, and an indistinct black ring ; wing covers marbled with ashen gray and dark brown blotches, transparent at apex ; hind wings sulphur yellow at base, followed by a black arcuate band, apex transparent, tipped with black.

Measurements.—Male : Length of body, 15 mm. ; wing covers, 17 mm. ; posterior femora, 10 mm. Female : Length of body, 25 mm. ; wing covers, 22 mm. ; posterior femora, 12 mm.

Found in the same localities as *Psinidia fenestralis*, and also in open places in the pine districts of New Jersey, but is less common. August and September.

ACRIDIDINÆ.

Acridium *Burmeister.*

Large size; vertex concave; median carina of pronotum distinct; lateral carina rounded; prosternum provided with a long, stout, blunt spine; wings well developed, as long or longer than the body. Last segment of male not swollen.

Acridium alutaceum *Harris.*

Plate IX, Fig. 2.

Dirty olive brown or green, with a rather broad, bright yellow longitudinal stripe on the top of the head and pronotum; wing covers brown, sometimes marked with darker dots; along the inner margin is a bright yellow stripe which becomes lost near the apex; hind wings transparent, yellowish at the base and becoming brownish towards the apex.

Measurements.—Male: Length of body, 28–32 mm.; wing covers, 25–27 mm.; hind femora, 16–20 mm. Female: Length of body, 48 mm.; wing covers, 39 mm.; hind femora, 24 mm.

Occurs in places covered with low bushes, especially *Myrica cerifera* and Sweet Fern, on which the insect usually rests. Common locally along the borders of marshy places. August and September.

Acridium rubiginosum *Harris.*

Plate IX, Fig. 1.

Head and thorax leathery or rusty brown; wing covers of the same color, sometimes sprinkled with small, darker colored spots; hind wings transparent; yellowish at base and brownish towards the apex.

Size of preceding species, from which it differs by its redder color and by the absence of the yellow stripe on the head, pronotum and wing covers. It also inhabits similar places.

Acridium americanum *Drury.*

Plate IX, Fig. 3.

Head with piceous and flesh-colored stripes; top of head with a broad yellowish longitudinal stripe running from the vertex to the end of the pronotum; pronotum pitchy brown with three yellow stripes on each side; abdomen pale yellow; wing covers semitransparent with a yellow stripe along the inner margin; remaining part thickly covered with large and distinct, dark semitransparent brown spots; costal margin at base yellow; wings transparent, yellowish; posterior femora buff inside and below, outside white with oblique transverse stripes meeting at the black stripe which runs along the middle; hind tarsi bright red, spines white, tipped with black.

Measurements.—Male: Length of body, about 43 mm.; wing covers, 45 mm.; posterior femora, 24 mm. Female: Length of body, 52 mm.; wing covers, 54 mm.; posterior femora, 28 mm.

Found from early in May until early in July, and again during the latter part of September until early in November. The flight of this insect is rapid and long; it often flies up into trees to escape capture. Quite rare in this vicinity, but common in the Southern States. It is the largest Grasshopper found in this vicinity.

Paroxya *Scudder.*

Body straight, subcylindrical; head rather larger; eyes prominent; antennæ longer in the male than in the female; pronotum twice as long as broad, median carina slight, lateral carina rounded, posterior lobe punctured; wings and wing covers of the male slightly shorter than the abdomen, in the female much shorter; hind femora reaching the tip of the abdomen; prosternum with a prominent subcylindrical spine.

Paroxya atlantica *Scudder.*

PLATE VIII, FIG. 5.

Top of head, pronotum and wing covers light or dark olive brown; face and sides of head bright yellow; behind the eyes commences a broad black band which also runs along the sides of the pronotum; lower part of pronotum bright yellow; abdomen yellow; anterior legs olivaceous; posterior femora outside olivaceous, inside yellow, black at apex; hind tibiæ lead-colored.

Measurements.—Male: Length of body, 23 mm.; wing covers, 13 mm.; posterior femora, 12 mm.; antennæ, 13 mm. Female: Length of body, 33 mm.; wing covers, 24 mm.; posterior femora, 17 mm.; antennæ, 10 mm.

Found in swampy places from July until early in October.

Paroxya floridana *Thomas.*

Recorded from New Jersey, and possibly will be found in this neighborhood.

Melanoplus *Stål.*

Head rounded on top; vertex continuous with the median sulcus of the face, with the portion between the eyes channelled; face with the lateral carina sharply defined; eyes prominent, nearly straight in front and rounded behind; antennæ slender, extending to the tip of the pronotum in the female, and beyond in the male; pronotum with a distinct median carina, the lateral carina obtuse and the transverse incisions more or less distinct. Wing covers long and narrow, as long, longer or shorter than the abdomen; hind wings somewhat shorter than the wing covers; first joint of hind tarsi as long as the last joint; pulvilli between the claws large; last joint of abdomen of the male much swollen.

Melanoplus femur-rubrum (*De Geer*).

PLATE VIII, FIG. 7.

Yellowish green, with a black patch behind the eyes and at the sides of the pronotum. Sides of thorax with an oblique yellow line; underside of abdomen and thorax bright yellow; hind femora yellowish green, shaded with black; hind tibiæ and tarsi coral red; wing covers olivaceous or fuscous, sometimes with a row of blackish spots along the middle; hind wings pellucid; cerci of male broad at base and pointed at the tip.

Measurements.—Male: Length of body, 20 mm.; wing covers, 18 mm.; posterior femora, 12 mm. Female: Length of body, 25 mm.; wing covers, 20 mm.; posterior femora, 15 mm.

Exceedingly common everywhere, from about the latter part of July until frost. It is sometimes very destructive to field crops, gardens, shrubs and young trees.

Melanoplus atlanis (*Riley*).

Very closely related to *M. femur-rubrum*, but may be separated by the following characters: The cerci of the male are broad, equal, and rounded at the tip and about twice as broad as long; tip of last abdominal segment notched. In the female the median carina on the anterior lobe of the pronotum is wholly wanting or very indistinct. In size and color like *M. femur-rubrum*.

Rather common in fields, from August until frost.

Melanoplus collinus (*Scudder*).

Head gray, pronotum grayish brown with a shining black patch on each side; hind femora beneath and inside yellow; outside grayish brown with three black bands encircling about half the femora above; hind tarsi red; wing covers reaching the tip of the abdomen. Cerci of male forked at the apex.

Measurements.—Male: Length of body, 19 mm.; wing covers, 13 mm.; posterior femora, 11 mm. Female: Length of body, 22–25 mm.; wing covers, 15 mm.; posterior femora, 12–14 mm.

Not uncommon during August and September in dry grassy fields. It may be easily known by the distinct black bands on the hind femora, its gray color and the forked cerci of the male.

Melanoplus punctulatus (*Scudder*).

Olive yellow; sides of pronotum with a black patch; hind femora with deep wine-red and olive-yellow bands, underside of femora crimson; tibiæ dirty red with a yellowish band at the base; tarsi with last joint tipped with black; wing covers olive brown with scattered black spots; hind wings pellucid, yellowish at base, dusky toward the apex; cerci of male flat, basal half narrow, outer half suddenly expanding, especially on one side; antennæ of male quite long.

Measurements.—Male: Length of body, 20–23 mm.; wing covers, 19–21 mm.; posterior femora, 11 mm. Female: Length of body, 25–29 mm.; wing covers, 17–18 mm.; posterior femora, 12–13 mm.

The habits of this species are very different from those of the other members of the genus. Instead of being an active creature, and living on the ground amongst the grass like other species of *Melanoplus*, it inhabits pine trees, and is sometimes found in numbers on the same tree. It is quite sluggish, and may be easily taken without making any or much effort to escape capture. Found during August and September. It is quite scarce in this vicinity, but rather common in certain parts of Connecticut and New York in the pine woods.

Melanoplus minor (*Scudder*).

Head and thorax grayish or brown; legs dirty yellow; hind femora brownish outside with traces of darker bands, underside orange; hind tibiæ lead color, or dull reddish in some individuals. Underside of body pale yellow; wing covers brown with a few small black spots along the middle; hind wings dusky at the apex, cinereous towards the base. Wing covers reaching the tip of the abdomen; cerci of male quadrate at base, somewhat compressed, longer than broad, outer portion rounded at tip, narrower than basal part, bent upward and grooved at the apex.

Measurements.—Male: Length of body, 17 mm.; wing covers, 12.5 mm.; posterior femora, 11 mm. Female: Length of body, 22 mm.; wing covers, 18 mm.; posterior femora, 12 mm.

Found during June and in July in dry grassy places, along the Palisades and in Westchester County, N. Y. Common locally. It may be readily known by its lead-colored hind tibiæ.

Melanoplus borealis (*Fieber*).

This species very much resembles *M. femur-rubrum*, but the wings and wing covers are much shorter than the body; the transverse furrow of the anterior lobe of the pronotum is indistinct, and upper half of the divergent lobes much darker than the pale lower half. Cerci of male nearly equal throughout.

Measurements.—Male: Length of body, 16 mm.; wing covers, 9 mm.; hind femora, 9 mm. Female: Length of body, 21 mm.; wing covers, 10 mm.; posterior femora, 12 mm.

Taken on the cranberry bogs at Jamesburg, N. J., during July and August.

Melanoplus bivittatus (*Say*).

Plate VIII, Fig. 8.

Yellowish green or grayish green, upper side of head and pronotum deep brown, the former with two yellow lines on top, continued along upper sides of the pronotum and extending to nearly the tip of the wing cases; underside of abdomen yellow; wings extending to the tip of the abdomen; femora marked with black outside, hind tarsi red; antennæ rufous.

Measurements.—Male: Length of body, 28 mm.; wing covers, 20 mm.; hind femora, 15 mm. Female: Length of body, about 38 mm.; wing covers, 24 mm.; hind femora, 20 mm.

This is the largest and clumsiest species of *Melanoplus* found in this vicinity. It may be readily known by the two yellowish stripes along the back. It inhabits damp or swampy meadows, covered with weeds and tall grass. Common from July to October.

Pezotettix *Burmeister*.

Allied to *Melanoplus*, but the wings and wing covers are absent or abbreviated.

Pezotettix scudderi *Uhler.*

PLATE VIII, FIG. 6.

Fusco-ferruginous; wing covers extending a little beyond the second abdominal segment; posterior femora yellow on the underside; hind tibia red with a black ring near the base.

Measurements.—Male, 16–17 mm. Female, 22–23 mm.

Not common in this neighborhood. Found from the latter part of August until the latter part of October, in dry places.

TETTIGINÆ.

Tettix *Latreille.*

Size small; form slender; head small, eyes globular, protruding; antennæ 13–14-jointed; pronotum compressed anteriorly, median carina distinct, hind portion extending back over the abdomen to or beyond its extremity, and terminating in a long narrow point; wing covers very short; wings fan-like, well developed, almost as broad as long, and as long or longer than the abdomen; lower anterior angle of sides of pronotum angulated and bent inward.

Tettix granulatus (*Kirby*).

Wholly grayish brown, and finely granulated; narrow, slender; pronotum much longer than the abdomen; vertex prominent, advancing in front of the eyes, with the front border angulated.

Measurements.—Length of body, 11 mm.; pronotum, 13 mm.; hind femora, 6 mm.

Found along roadsides, usually in damp places, from April to September.

Tettix cucullatus (*Burmeister*).

Resembles *T. granulatus*, but the vertex is narrower and does not project beyond the eyes; the front of the vertex is cut square and is not angulated as in *T. granulatus*. The pronotum is also broader and the median carina less distinct.

Measurements.—Length of body, 10 mm.; pronotum, 12 mm.; posterior femora, 6 mm.

Found in similar localities as the preceding species.

Tettix ornatus (*Say*).

Smaller than *T. cucullatus*, with various styles of ornamentations. Vertex slightly advancing beyond the eyes, with the front border rounded and the median carina projecting; pronotum extending beyond the abdomen. In color it is cinereous, with yellowish and black markings.

Measurements.—Length of body, 10 mm.; pronotum, 11 mm.; posterior femora, 5 mm.

Found from April until September.

Tettix triangularis (*Scudder*).

Allied to *T. ornatus*, but differs by having the pronotum slightly extending beyond the tip of the abdomen, and not prolonged into a long slender point as in *T. ornatus*.

Measurements.—Length of body, 9 mm.; pronotum, 9 mm.; posterior femora, 5 mm.

It is considered as a variety of *T. ornatus*, and is found in the same localities.

Tettigidea *Scudder*.

Size small; form robust and clumsy; head large and broad, with the front less sloping and with median ridge of the face more prominent than in the genus *Tettix;* antennæ 21–22-jointed; lower anterior angle of sides of pronotum rounded and not bent inward as in *Tettix;* front border of the pronotum thrust forward and partly concealing the head; median carina straight, somewhat curved anteriorly; lateral carina less prominent than in *Tettix*, and not so strongly bent inward in advance of the broader portion of the pronotum.

Tettigidea lateralis (*Say*).

Plate X, Fig. 7.

Head and sides of body blackish brown; hind femora with a rather large ochraceous spot outside about the middle; underside of body dirty yellow; top of pronotum light or dark testaceous, sometimes the same color as the sides of the body, with a testaceous border. In the male the face and lower anterior portion of the pronotum are yellow. Wings and pronotum extending beyond the abdomen, wings somewhat longer than the pronotum.

Measurements.—Male: Length of body, 10 mm.; pronotum, 11 mm.; posterior femora, 6 mm. Female: Length of body, 14 mm.; pronotum, 15 mm.; posterior femora, 7.5 mm.

Found from April until September.

Tettigidea polymorpha (*Burmeister*).

PLATE X, FIG. 8.

Closely allied to *T. lateralis* in color and form, but the pronotum extends to the tip of the abdomen, and the wings are somewhat shorter.

Found in the same places and time as *T. lateralis.*

Batrachidea *Serville.*

Head somewhat enlarged and the space between the eyes distant; antennæ 12-jointed; pronotum reaching the extremity of the abdomen, with the median carina very high and arched; legs stout.

Batrachidea cristata (*Harris*).

PLATE X, FIG. 9.

Vertex projecting beyond the eyes, front border well rounded, a little angulated; median carina sharp, prominent, and sloping backwards; the pronotum is finely granulated, usually with two black spots on each side near the anterior portion above, otherwise the insect is wholly fuscous.

Measurements.—Length of body, 10 mm.; posterior femora, 5.5 mm.

Found from April to October. *B. carinata* is considered a long-winged variety of *B. cristata.*

Synopsis of Species of Acrididæ.

Truxalis.

Face very oblique; vertex in form of a long, blunt cone or pyramid; antennæ flattened.
  Color, green and brown; wings and wing covers extending beyond the abdomen........ .... *T. brevicornis.*

Opomala.

Head as in *Truxalis.*
  Color, light brown; wings and wing covers much shorter than the abdomen ....*O. brachyptera.*

Chloëaltis.

Top of head rounded; vertex produced into a short, blunt pyramid; pronotum parallel.
  Green or brown; wings shorter than the abdomen (female) or nearly as long (male)... ....*C. viridis.*
  Wings of female extending to the tip of the abdomen....var. *punctulatus.*
  Grayish brown speckled with black; hind femora with two light patches outside; sides of pronotum marked with black (female) or wholly black (male)................ ....*C. conspersa.*

Stenobothrus.

Pronotum constricted before the middle ; head similar to *Chloëaltis* ; body slender and narrow.

Green and brown ; wings and wing covers extending beyond the abdomen .... *S. maculipennis.*

Nearly like *maculipennis*, with the vertex more angulate with front in profile.. *S. olivaceus.*

Wings and wing covers extending to tip of the abdomen...... *S. æqualis.*

Wing covers yellowish, shorter than the abdomen ; hind tibiæ red, knees black... .... *S. curtipennis.*

Wings and wing covers as long or longer than the abdomen, var. *longipennis.*

Chortophaga.

Pronotum acutely angled behind ; median carina elevated.

Grass green ; wing covers sometimes with brown stripe ; hind wings yellowish green at base, translucent......... .. ..*C. viridifasciata.*

Dusky brown, wing covers with darker patches...........var. *infuscata.*

Encoptolophus.

Head swollen ; pronotum constricted at the sides, triangular behind, median carina cut in the middle by a distinct notch.

Dusky brown ; wing covers with lighter fasciæ ....*E. sordidus.*

Arphia.

Pronotum keel-shaped, arcuate, acutely angled behind.

Brown ; hind wings at base bright sulphur yellow ; pronotum sharply angled behind.... ....*A. xanthoptera.*

Smaller species, color like *xanthoptera*, pronotum triangular behind, *A. sulphurea.*

Hippiscus.

Robust species ; pronotum very broad, rugose ; median carina distinct, slightly notched before the middle.

Ashy lead color ; wing covers with fuscous blotches, axillary fold yellowish ; hind wings coral red at base............*H. tuberculatus.*

Ashen gray with darker shades, pronotum tinged with olive green ; wing covers with many large dark spots ; hind wings orange red at base........ ....*H. phœnicopterus.*

Dissosteira.

Median carina of pronotum notched, arched on the posterior lobe, straight on anterior lobe.

Varies from sepia to rusty brown ; hind wings black with a yellow outer border................................. ... *D. carolina.*

Trimerotropis.

Median carina of pronotum not very distinct, and broken by two wide notches.

White, with fine black atoms ; hind wings pale translucent, yellow at base . ... *T. maritima*

Spharagemon.

Head tumid ; vertex broad ; pronotum acute angled behind ; median carina elevated, compressed and notched.

Light or dark brownish fuscous, with darker markings ; hind wings pale yellow at base ; hind tibiæ coral red with a broad black and white band at base......................... .. .. *S. bollii.*

Ashen gray, profusely marked with black ; hind tibiæ coral red with a white band near the base................ ....*S. saxatile.*

Brown, mottled with fuscous ; hind tibiæ red with an obsolete white ring near the base..................................*S. æquale.*

Circotettix.

Pronotum flattened on top, acute angle behind; median carina with two notches before the middle.

Ashen gray, profusely marked with black; hind wings pale yellow at base; hind tarsi yellowish, with three indistinct black bands.................................... *C. verruculatus.*

Psinidia.

Small species: Head large; antennæ flattened; pronotum granulated, much compressed before the middle, median carina with two notches.

Ash colored, variegated with gray and brown. Hind wings pink or yellow at base.................................. *P. fenestralis.*

Scirtettica.

Small species: Pronotum less elevated than *Psinidia;* median carina with one notch before the middle.

Ashen gray, marbled with darker markings; hind wings sulphur yellow at base; hind tibiæ red with black ring at base followed by a white and black ring........................ *S. marmorata.*

Acridium.

Large and robust species; pronotum obtuse angled behind, median carina distinct, lateral carina rounded.

Yellowish green, with a distinct yellow line running from the head to the tip of wing covers, which are brown........... *A. alutaceum.*

Leathery brown, without the yellow stripe.............. *A. rubiginosum.*

Piceous, with flesh-colored and yellow stripes on the head and pronotum; wing covers covered with dark brown spots.... *A. americanum.*

Paroxya.

Small species; pronotum twice as long as broad, slightly rounded behind, smooth, posterior lobe punctured.

Olive brown, face and sides yellow; behind the eyes a black stripe running to the end of the pronotum................ *P. atlantica.*

Melanoplus.

Allied to *Paroxya;* pronotum shorter, with the lateral carina on the anterior lobes indistinct; anal segment of male swollen.

Yellowish; wing covers fuscous; hind tibiæ red; cerci of male broad at base, pointed at the tip................ *M. femur-rubrum.*

Similar to *femur-rubrum;* cerci of male about twice as long as broad, rounded at tip................................ *M. atlanis.*

Grayish; hind femora with three distinct black bands above; hind tibiæ red; cerci of male forked at the tip.............. *M. collinus.*

Olive yellow; wing covers olive gray; hind femora with wine-red and yellow bands; cerci of male flat, basal half narrow, outer half expanded on one side .... *M. punctulatus.*

Grayish brown; hind tibiæ lead colored, rarely dull reddish; cerci of male quadrate at base, longer than broad, outer portion rounded at tip and narrower than basal part, bent upwards and grooved at the apex.............................. *M. minor.*

Like *femur-rubrum*, but the wings and wing covers much shorter than the abdomen; cerci of male nearly equal throughout, *M. borealis.*

Robust; yellowish green, with two yellow lines running from behind the eyes to the end of the pronotum and along the wing covers, *M. bivittatus.*

Pezotettix.

Allied to *Melanoplus;* wing covers abbreviated.

Fusco-ferrugineous; hind tibiæ red with a black ring at base, *P. scudderi.*

Tettix.

Minute species: Pronotum extending back over the abdomen to or beyond its extremity.

Grayish brown, finely granulated; pronotum extending much beyond the abdomen; vertex angulated, advancing in front of the eyes.......... .. .. *T. granulatus.*

Vertex narrower, not projecting beyond the eyes; not angulated, *T. cucullatus.*

Pronotum shorter than in the two preceding species; fuscous, with various styles of ornamentation.............. ...... *T. ornatus.*

Like *T. ornatus*, but the pronotum not extending beyond the abdomen .. .. *T. triangularis.*

Tettigidea.

Minute species: Allied to *Tettix*; robust; lower anterior angle of sides of pronotum rounded and not bent inward as in *Tettix.*

Hind femora with a rather large pale spot outside; top of pronotum light or dark brown, extending beyond the abdomen..... *T. lateralis.*

Allied to *T. lateralis*; pronotum reaching the tip of the abdomen, *T. polymorpha.*

Batrachidea.

Median carina much elevated, arcuate, extending to the tip of abdomen or beyond.

Fuscous, with two black spots on each side on top of the pronotum, *B. cristata.*

EXPLANATION OF PLATES.

Plate V.

Fig. 1.—*Anisolabis maritima* Bon. Female.
Fig. 2.—*Stylopyga orientalis* (Linn.). Male.
Fig. 3.— “ “ “ Female.
Fig. 4.—*Periplaneta americana* (Linn.). Female.
Fig. 5.—*Gryllotalpa columbia* Scudder. Female.
Fig. 6.—*Gryllus pennsylvanicus* Burm. Male.
Fig. 7.— “ “ “ Female.
Fig. 8.— “ *domesticus* Linn. Male.
Fig. 9.—*Nemobius fasciatus* (De Geer). Male.
Fig. 10.— “ *vittatus* (Harr.). Female.
Fig. 11.— “ *affinis* Beut. Female.
Fig. 12.—*Œcanthus niveus* (De Geer). Male.
Fig. 13.— “ “ “ Female.
Fig. 14.—*Xabea bipunctata* (De Geer). Female.
Fig. 15.—*Tridactylus terminalis* Scudder. Female.
Fig. 16.—*Phylloscirtus pulchellus* (Uhler). Male.
Fig. 17.—*Ceuthophilus grandis* Scudder. Female.

Plate VI.

Fig. 1.—*Cyrtophyllus concavus* (Harris). Male.
Fig. 2.—*Amblycorypha rotundifolia* (Scudder). Female.
Fig. 3.—*Microcentrum laurifolium* (Linn.). Female.
Fig. 4.—*Orchelimum vulgare* Harris. Male.
Fig. 5.— “ “ “ Female.
Fig. 6.—*Xiphidium brevipennis* Scudder. Female.
Fig. 7.— “ *fasciatum* (De Geer). Female.
Fig. 8.—*Conocephalus ensiger* Harris. Male.
Fig. 9.— “ *robustus* Scudder. Female.

Plate VII.

Fig. 1.—*Conocephalus exiliscanorus* Davis. Male.
Fig. 2.— “ “ “ Female.
Fig. 3.— “ *dissimilis* Serville. Male.
Fig. 4.— “ “ “ Female.
Fig. 5.—*Scudderia curvicauda* (De Geer). Male.
Fig. 6.— “ “ “ Anal spines.
Fig. 7.—*Atlanticus pachymerus* (Burm.). Male.
Fig. 8.— “ *dorsalis* (Burm.). Female.
Fig. 9.—*Chloëaltis conspersa* Harris. Male.
Fig. 10.— “ *viridis* Scudder. Female.

PLATE VIII.

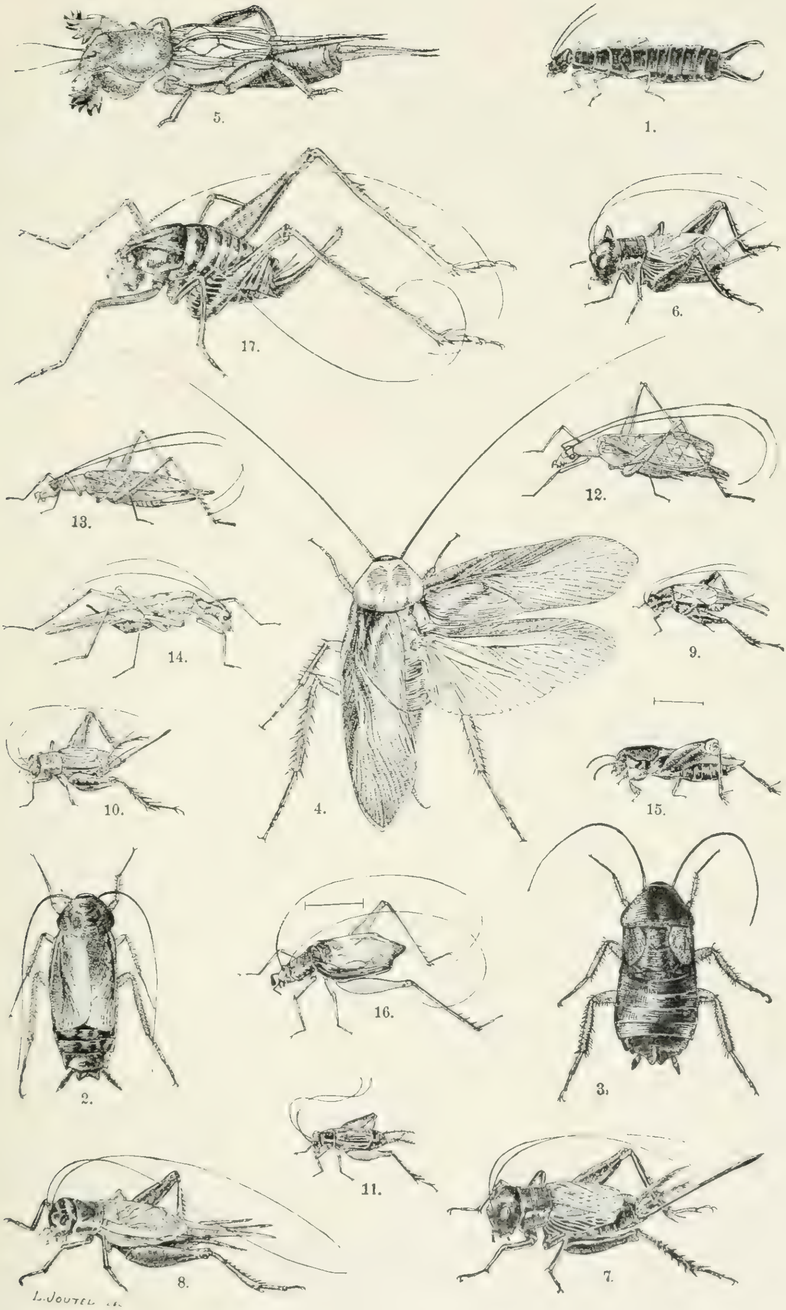
Fig. 1.—*Truxalis brevicornis* Linn. Male.
Fig. 2.— " " " Female.
Fig. 3.—*Psinidia fenestralis* Serville. Female.
Fig. 4.—*Stenobothrus maculipennis* Scudder. Female.
Fig. 5.—*Paroxya atlantica* Scudder. Female.
Fig. 6.—*Pezotettix scudderi* Uhler. Female.
Fig. 7.—*Melanoplus femur-rubrum* (De Geer). Female.
Fig. 8.— " *bivittatus* (Say). Female.
Fig. 9.—*Chortophaga viridifasciata* (De Geer). Female.
Fig. 10.—*Arphia sulphurea* (Harris). Male.
Fig. 11.— " *xanthoptera* (Germar). Male.

PLATE IX.

Fig. 1.—*Acridium rubiginosum* Harris. Female.
Fig. 2.— " *alutaceum* Harris. Female.
Fig. 3.— " *americanum* (Drury). Female.
Fig. 4.—*Hippiscus phœnicopterus* (Germar). Male.
Fig. 5.—*Spharagemon æquale* (Say). Female.
Fig. 6.—*Circotettix verruculatus* (Kirby). Female.

PLATE X.

Fig. 1.—*Spharagemon bollii* Scudder. Male.
Fig. 2.—*Encoptolophus sordidus* (Burm.). Female.
Fig. 3.—*Hippiscus tuberculatus* (Pal. de Beauv.). Male.
Fig. 4.—*Scirtettica marmorata* (Harris). Male.
Fig. 5.—*Trimerotropis maritima* (Harris). Female.
Fig. 6.—*Dissosteira carolina* (Linn.). Female.
Fig. 7.—*Tettigidea lateralis* (Say). Female.
Fig. 8.— " *polymorpha* (Burm.). Female.
Fig. 9.—*Batrachidea cristata* (Harris). Female.
Fig. 10.—*Diapheromera femorata* (Say). Female.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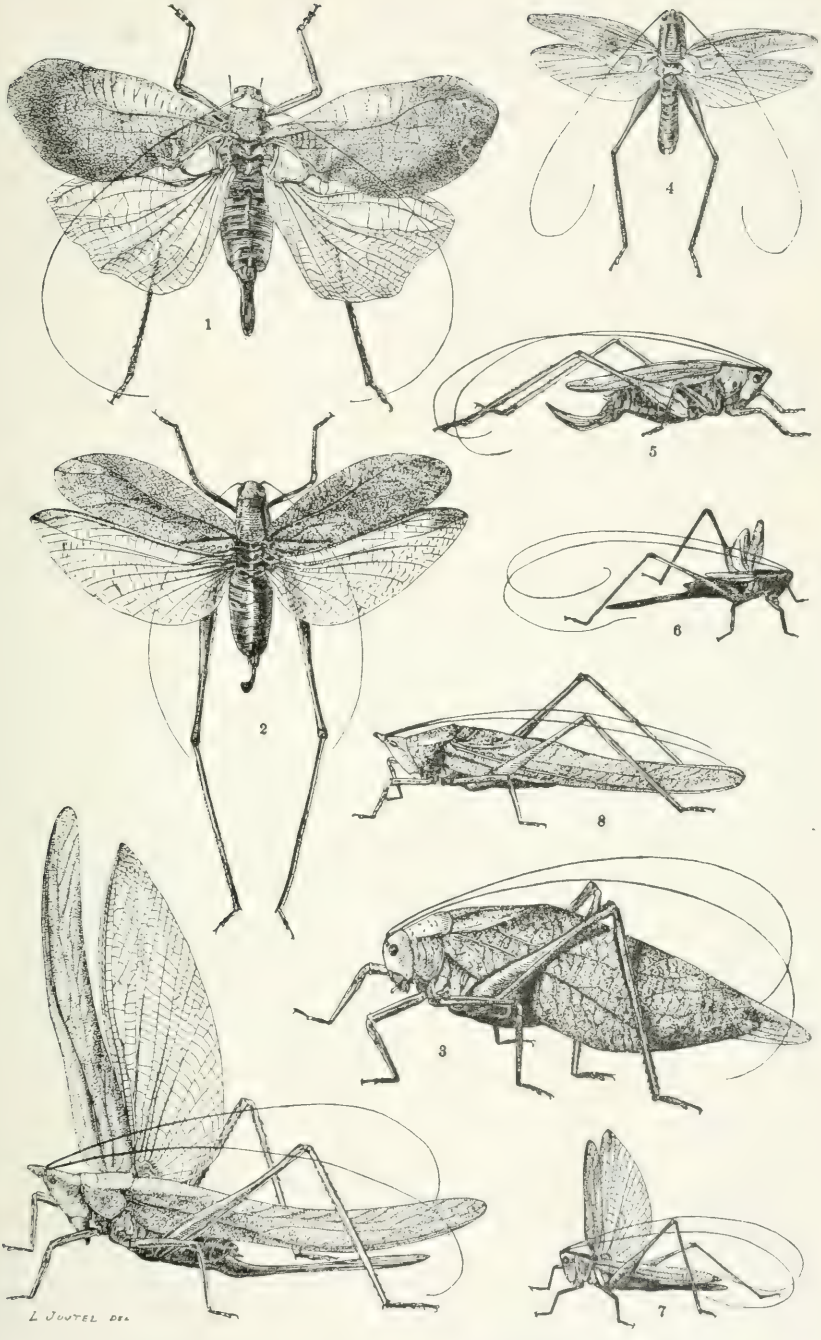
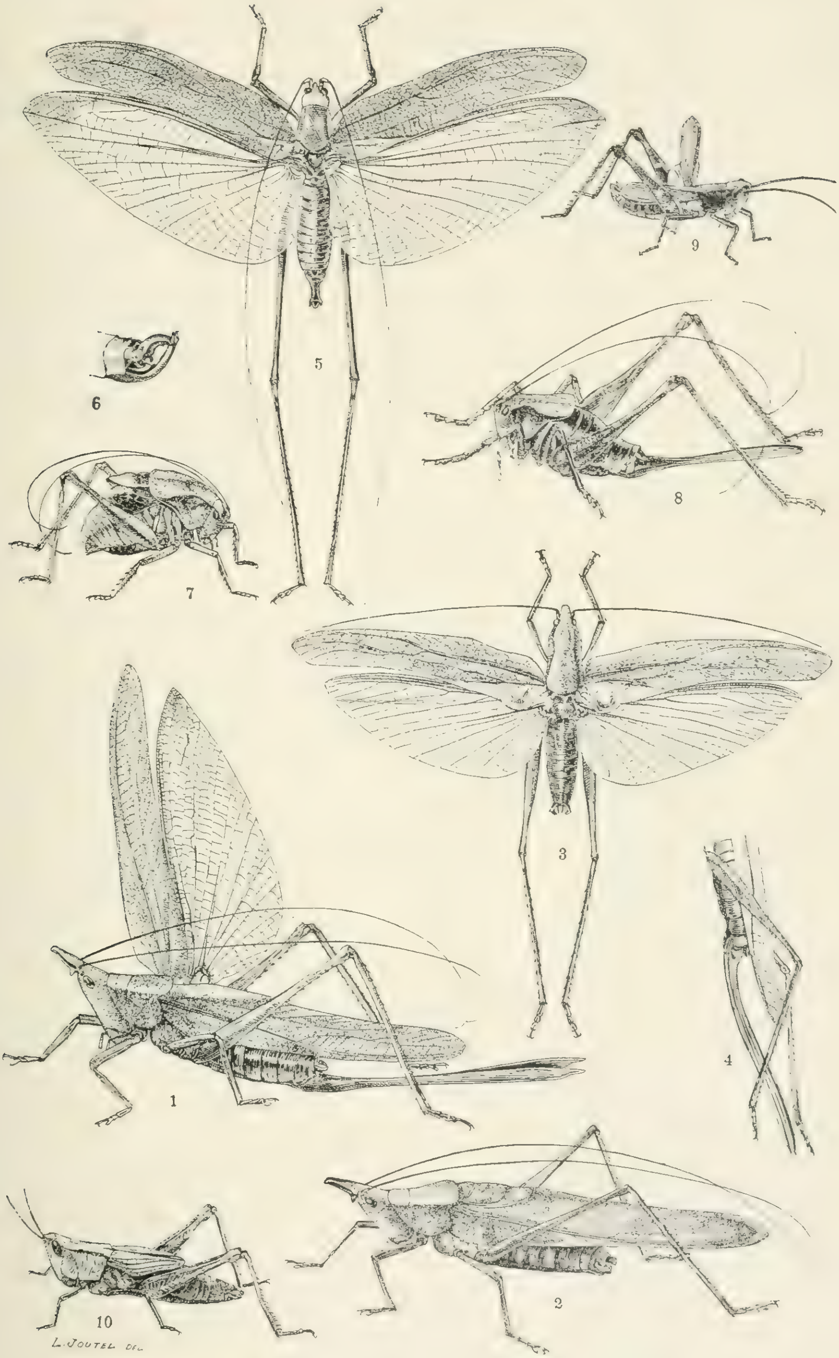
1. Anisolabis maritima.
2. Stylopyga orientalis.
3 “ “
4. Periplaneta americana.
5. Gryllotalpa columbia.
6. Gryllus pennsylvanicus.
7. Gryllus pennsylvanicus
8. “ domesticus.
9. Nemobius fasciatus.
10. “ vittatus.
11. “ affinis.
12. Œcanthus niveus.
13. Œcanthus niveus.
14. Xabea bipunctata
15. Tridactylus terminalis.
16. Phylloscirtus pulchellus.
17. Ceuthophilus grandis.



1. Cyrtophyllus concavus.
2 Amblycorypha rotundifolia.
3. Microcentrum laurifolium.
4. Orchelimum vulgare.
5. " "
6. Xiphidium brevipennis.
7. " fasciatum.
8. Conocephalus ensiger.
9. " robustus.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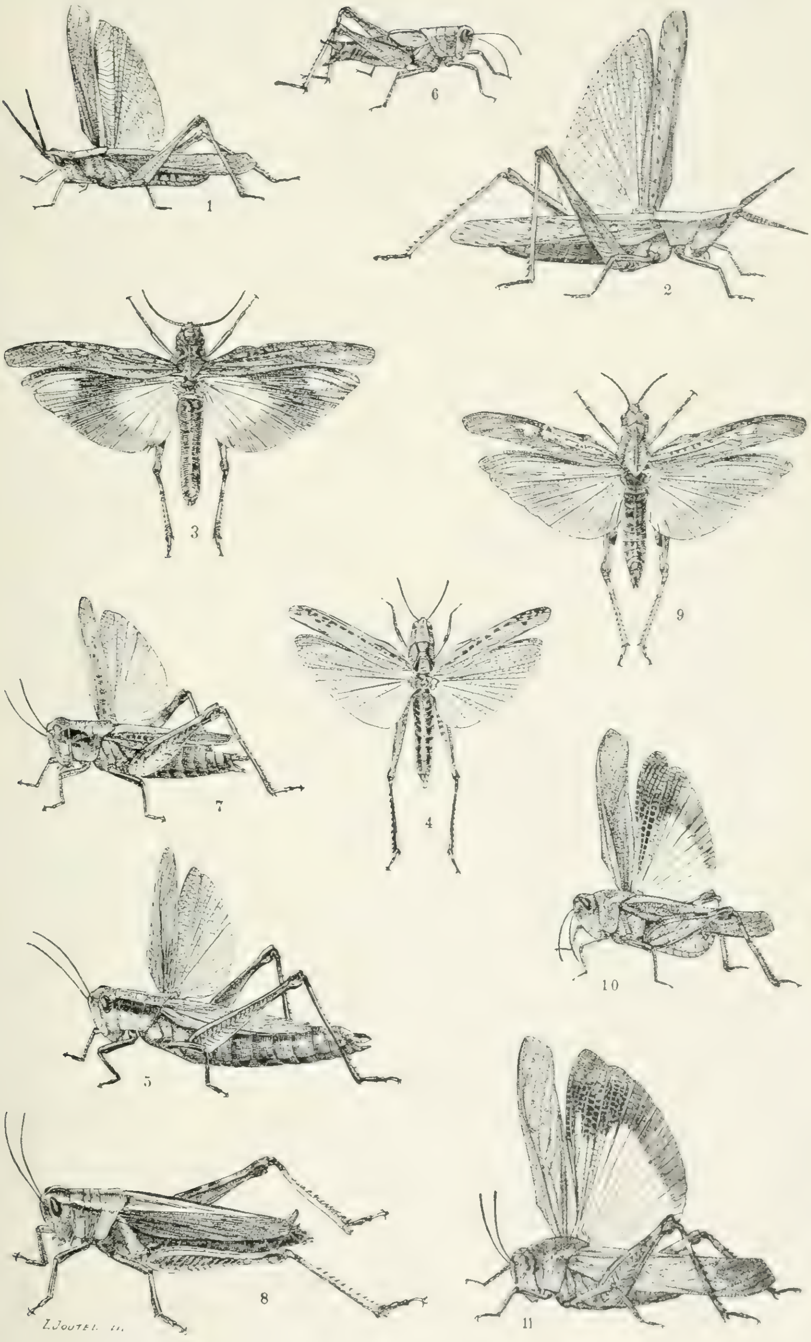
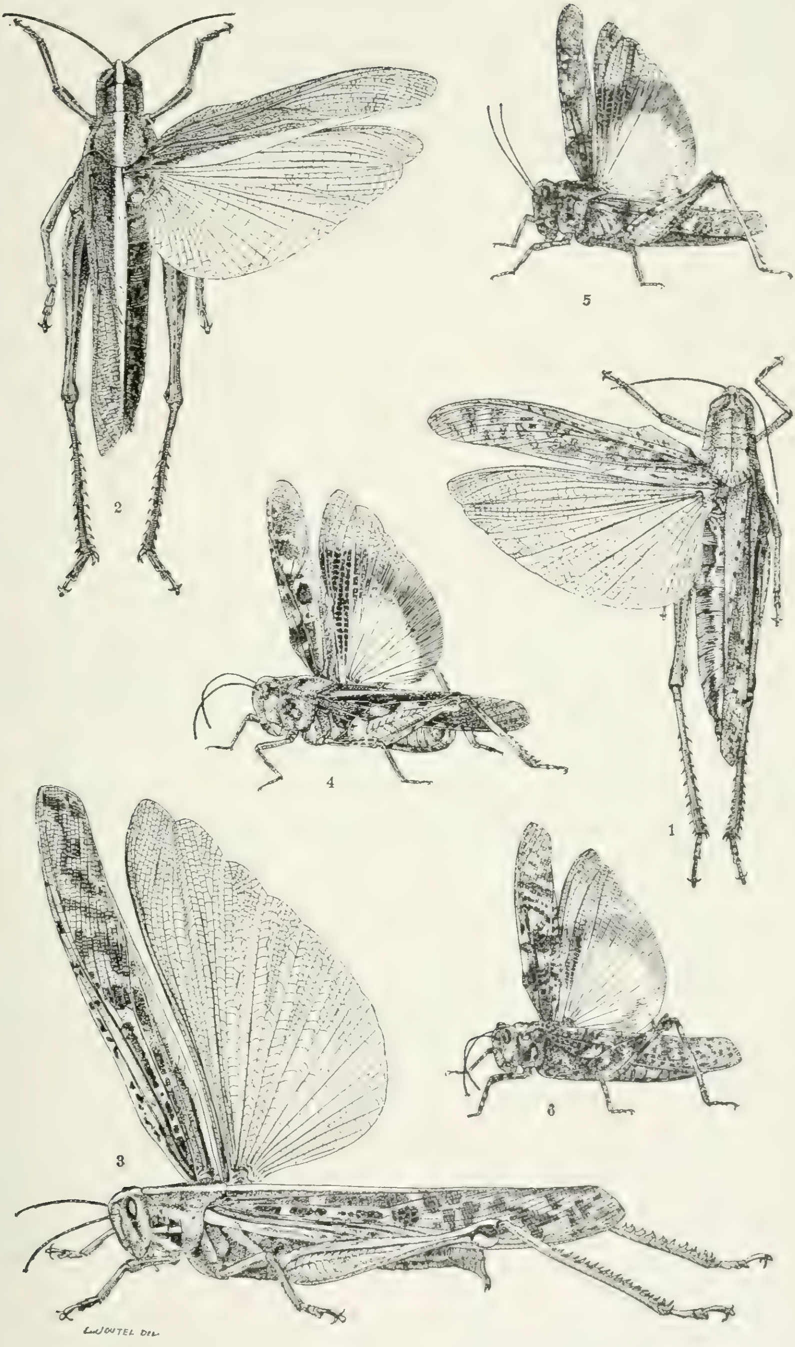
1. Conocephalus exiliscanorus.
2. “ “
3. “ dissimilis.
4. “ “
5. Scudderia curvicauda.
6. Scudderia curvicauda, anal spines.
7. Atlanticus pachymerus.
8. “ dorsalis.
9. Choealtis conspersa.
10. “ viridis.



1. Truxalis brevicornis.
2. " "
3. Psinidia fenestralis.
4. Stenobothrus maculipennis.
5. Paroxya atlantica.
6. Pezotettix scudderi.
7. Melanoplus femur-rubrum.
8. " bivittatus.
9. Chortophaga viridifasciata.
10. Arphia sulphurea.
11. " xanthoptera.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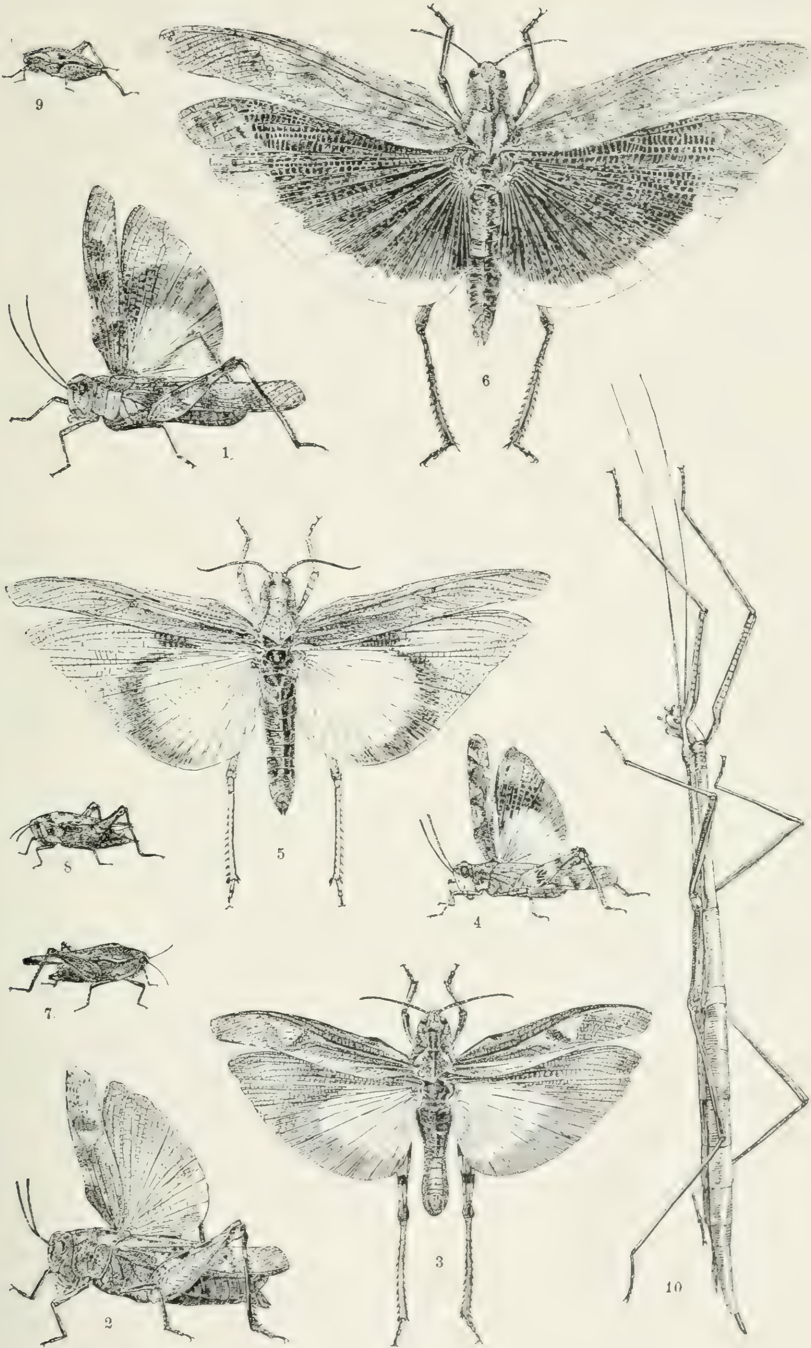
E. L. Joutel del.

1. Acridium rubiginosum.
2. " alutaceum.
3. " americanum.
4. Hippiscus phoenicopterus.
5. Spharagemon æquale.
6. Circotettix verruculatus.



1. Spharagemon bollii.
2. Encoptolophus sordidus.
3. Hippiscus tuberculatus.
4. Scirtettica marmorata.
5. Trimerotropis maritima.
6. Dissosteira carolina.
7. Tettigidea lateralis.
8. " polymorpha.
9. Batrachidea cristata.
10. Diapheromera femorata.

Article XIII.—DESCRIPTIONS OF TEN NEW NORTH AMERICAN MAMMALS, AND REMARKS ON OTHERS.

By J. A. ALLEN.

The large additions made during the last few months to the collection of mammals in the American Museum include a number of undescribed forms, mainly from the collections of Messrs. W. W. Price and W. W. Granger. Mr. Price's collection, made in southeastern Arizona, alone numbers about 1500 specimens, one-half of which has been purchased by the Museum. The whole collection, however, has been kindly sent by Mr. Price to the Museum for determination, and will form the basis of a special paper on the mammals of southern Arizona, to be published shortly in the Museum 'Bulletin,' Mr. Price contributing his important field notes, covering nearly a year's work of himself and assistants. In addition to the several new species discovered, his observations and collections greatly extend the hitherto recorded range of many species of mammals. Thus the known range of *Tamias cinereicollis*, *T. lateralis*, *Sciurus hudsonius mogollonensis*, *Arvicola alticolus*, and *Sitomys americanus rufinus* has been carried from the San Francisco Mountains southeastward along the Pine Plateau region to the White Mountains, and some of them to the Chiricahua and Graham Mountains ; and the large *Nyctinomus macrotis nevadensis*, described by Dr. Harrison Allen from Nevada, has been found by Mr. Price in the Chiricahua Mountains. Much light has also been thrown upon the range of various other species in southern Arizona.

Mr. Granger's collection, numbering over 500 specimens, collected mainly in South Dakota, contains several species new to the fauna of the Black Hills region, and will also be made the subject of a special report.

The measurements given in the following paper were taken by the collector from the fresh specimen before skinning, unless otherwise stated.

Perognathus pricei, sp. nov.

Above gray, lined with black ; no fulvous lateral line ; beneath white ; tail strongly crested penicillate, dark above, becoming blackish distally, white below ; ears dusky ; feet grayish white, soles naked. Pelage rather harsh but not spiny.

Measurements.—Total length (type), 157 mm.; tail vertebræ, 90 ; pencil at tip of tail, 10 ; hind foot, 23 ; ear, 7.5. Average of 5 adult specimens (4 ♂♂, 1 ♀) : Total length, 151 ; tail vertebræ, 82 ; hind foot, 22 ; ear, 8.

Skull.—Total length, 23 ; basilar length,[1] 18 ; mastoid breadth, 12 ; length of nasals, 8 ; breadth of interparietal, 8 ; greatest length of interparietal, 4 ; length of mastoid area, 12. The interparietal is large, distinctly pentagonal, twice as broad as long. The mastoid area is correspondingly reduced.

Type, No. $\frac{8359}{6685}$, ♂ ad., Oposura, Sonora, May 31, 1894 ; B. C. Condit (Price Collection).

Named for Mr. W. W. Price, in recognition of his important mammalogical explorations in southern Arizona.

This species is based on 5 adult specimens (4 males and 1 female) taken at Oposura, Sonora, May 30 and 31, 1894, by Mr. B. C. Condit, of Mr. W. W. Price's Arizona Expedition.

This species appears to bear no close resemblance to any hitherto described. In color it somewhat resembles *P. intermedius* Merriam, which is, however, a much larger species, with very different cranial characters, and not nearly so clear gray.

Perognathus conditi, sp. nov.

Above yellowish gray, lined with black ; a broad pale fulvous lateral line ; feet and lower parts white ; ears grayish dusky ; tragus about as high as broad ; tail dusky above, white below, not crested, and only very slightly tufted at the end. Soles naked.

Measurements.—Total length (type), 197 mm. ; tail vertebræ, 88 ; hind foot, 27 ; ear, 10. Another specimen (♂ ad.), measures : Total length, 193 ; tail vertebræ, 87 ; hind foot, 24.5 ; ear, 12.

Skull.—Total length, 29 ; basilar length, 24 ; greatest mastoid breadth, 14 ; length of nasals, 10.5 ; breadth of interparietal, 7 ; greatest length of interparietal, 5. The interparietal is large, pentagonal, with the posterior lateral borders much rounded ; mastoid area only moderately developed.

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[1] Front border of intermaxillæ to posterior border of occipital condyles.

Type, No. $\frac{8360}{6686}$, ♂ ad., San Bernardino Ranch, southeastern corner of Cochise Co., Arizona, March 23, 1894 ; B. C. Condit (Price Collection).

Named for Mr. B. C. Condit, an associate of Mr. Price in his explorations in Arizona.

This species should probably be compared with *P. baileyi* Merriam from Sonora, but it is apparently smaller, more fulvous, with the tail less crested, and the interparietal more pointed in front and more rounded on the postero-lateral borders.

Represented by 3 specimens (1 ad. ♂, 1 young ad. ♂, and 1 ♂ juv.) taken at San Bernardino Ranch, Cochise Co., Arizona, March 23 and May 1, 1894. The young specimen is grayer and less fulvous than the adults, the type being scarcely distinguishable in color from Kansas and South Dakota specimens of *P. paradoxus*, and the tail is quite as sparsely haired. In fact, in point of color, *P. conditi* is not readily distinguishable from specimens of *P. paradoxus* from the southeastern base of the Black Hills; and cranially the differences are by no means strongly marked.

Reithrodontomys mexicanus fulvescens, subsp. nov.

Above yellowish brown, more or less heavily lined with black ; a bright, strongly marked fulvous lateral line ; below whitish, the basal two-thirds of the pelage plumbeous ; ears dusky externally, rusty within, well clothed with fine short hairs ; tail indistinctly bicolor, pale brown above, lighter below, sparsely haired, but the hairs pretty thoroughly concealing the annulations ; feet soiled white, heels sparsely covered as far as the first tubercle with fine short hairs.

Measurements.—Total length (type), 183 mm.; tail vertebræ, 102 ; hind foot, 19 ; ear, 14. Average of three adults (2 ♂♂, 1 ♀) : Total length, 172 ; tail vertebræ, 99 ; hind foot, 19.3 ; ear, 14.7. Eight adult specimens of *R. mexicanus* from Brownsville, Texas, average : Total length, 178 ; tail vertebræ, 98 ; hind foot, 20.

Type, No. $\frac{8411}{6736}$, ♂ ad., Oposura, Sonora, June 1, 1894 ; B. C. Condit (Price Collection).

This subspecies is represented by three adult specimens taken by Mr. B. C. Condit at Oposura, Sonora, May 31 and June 1, 1894. It presents an astonishingly close resemblance, in size and proportions, to September specimens of *R. mexicanus*[1] from

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[1] The type locality of *R. mexicanus* (Saussure) was Tehuacan, State of Puebla, Mexico, from which region, however, no material is at present available for comparison.

Brownsville, Texas, but the pelage is softer and fuller, and the color above more strongly yellowish ; the tail and heels are also slightly more hairy ; but it is far from certain that these differences are not in large part seasonal, though hardly probable.

The Price Collection also contains 6 specimens of *R. megalotis* from Fairbank, Arizona, and 5 specimens from the Chiricahua Mountains that seem indistinguishable from *R. longicaudus.* The series of *R. megalotis* is from very near the type locality of the species.

Arvicola leucophæus, sp. nov.

Middle region of upper parts suffused with pale reddish brown, conspicuously lined with black, and slightly tinged with gray ; sides grayer and less reddish, and less lined with black ; underparts strongly whitish gray, the fur plumbeous at base with long whitish tips, concealing the plumbeous underfur, and giving a general whiteness to the whole underparts. Tail brown above, whitish below, of medium length. Feet dusky above, strongly washed with gray.

Measurements.—Total length (type), 173 mm.; tail vertebræ, 50 ; hind foot, 22.5 ; ear, 16. Average of 3 adult specimens (1 ♂, 2 ♀♀) : Total length, 166 ; tail vertebræ, 49 ; hind foot, 22.7 ; ear, 15.

Skull.—Total length, 28 ; basilar length, 21 ; greatest zygomatic breadth, 16 ; greatest parietal breadth, 12.5 ; least interorbital breadth, 4 ; length of nasals, 8.5 ; upper molar series, 6.5. The brain-case is broad and flat ; the interorbital region is remarkably broad ; rostrum also broad ; angle of mandible exceptionally developed, even broader and heavier than in the much larger *A. edax.* Dentition as in the *Mynomes* section generally, but the molars are narrow in proportion to the heavy development of the skull.

Type, No. $\frac{8109}{6734}$, ♂ ad., Graham Mountains, Arizona, July 18, 1894 ; Price and Condit (Price Collection).

This species is represented by 4 specimens (1 ♂, 2 ♀♀ ad., 1 ♀ juv.), taken by Messrs. Price and Condit in the Graham Mountains, Arizona, July 18 and 19, 1894. It is readily distinguished externally by the whiteness of the underparts ; the coloration above is perhaps slighty more ferrugineous than that of *A. alticolus,* which is, however, a somewhat larger species, with a relatively longer tail. In cranial characters it appears to most resemble *A. edax,* but differs from it in much smaller size, lighter dentition, relatively greater interorbital breadth, and the still greater development of the mandibular angle.

The Price Collection also contains three specimens of an *Arvicola* from the White Mountains, Arizona, which I provisionally refer to *A. alticolus.*

Sitomys americanus arizonæ, subsp. nov.

Similar in coloration to *S. a. gambeli*, but smaller, with relatively shorter tail and slightly larger ears. Above pale wood brown, slightly darker along the middle of the back, and lighter or more ashy on the sides, generally with no trace of a lateral line ; feet and beneath white, the basal half of the pelage plumbeous ; tail dusky above, grayish white below.

Young, in first pelage.—Above dark plumbeous slate ; below whitish, the plumbeous underfur showing through the surface.

Measurements.—Total length (type), 158 mm.; tail vertebræ, 67 ; hind foot, 24 ; ear, 17. Average of 42 adults : Total length, 160 (145–183) ; tail vertebræ, 65 (57–80) ; hind foot, 22.5 (20–24) ; ear, 17 (16–18).

Type, No. $\frac{8416}{6743}$, ♂ ad., Fairbank, Arizona, March 13, 1894 ; Price and Condit (Price Collection).

This is a strongly marked form of the short-tailed or *sonoriensis* group of the genus *Sitomys*, characterized by the nearly uniform brownish gray color of the entire upper parts. It is represented by a series of nearly 70 specimens, 50 of which (all adult but two) were taken at Fairbank, Arizona, Feb. 22 to March 13, 1894. This series is remarkably uniform in coloration, though the extremes vary considerably in size. Two or three specimens show a slight fulvous wash, approaching the color of a pale *Sitomys eremicus.* All the specimens of *Sitomys* obtained at Fairbank, except a few examples of *S. eremicus*, were of this form.

I also refer to this species a series of 20 specimens from San Bernardino Ranch, taken March 21 to May 4. These consist of young in various stages of immaturity, from nurslings up to breeding females which still retain the plumbeous pelage of the young. At first they were thought to represent a distinct species, characterized by a permanent plumbeous coloration, but on comparing the older examples of the series with the Fairbank specimens it became at once evident that they must be referred to

S. a. arizonæ, there being a few specimens in the San Bernardino series which completely connect the two.

The large series obtained in the White, Chiricahua and Graham Mountains are of the *rufinus* type, from which, however, some of these several mountain strains of reddish, short-tailed *Sitomys* may perhaps be separable as local races of the *sonoriensis* group.

Neotoma campestris, sp. nov.

Similar in size and cranial characters to *Neotoma micropus*, but very different in coloration. Above yellowish gray, varying to buffy ochraceous, finely lined with black-tipped hairs, which are conspicuous over the median dorsal region, and more sparingly developed on the sides; head slightly lighter and more grayish; feet, to considerably above ankles and wrists, pure white; throat, breast, middle of abdominal region, and posterior third of ventral surface pure white to base of the hairs, the pelage here long, soft and cottony; the whiteness of the underparts also extends well up on the sides of the body, where, however, the basal portion of the fur is plumbeous. Ears rather small, thinly haired, dusky, narrowly rimmed with white. Tail thickly haired, the hairs everywhere concealing the annuli, pale grayish brown above, sides and below pure white.

Young (one-fourth grown) are clear ashy gray above, more or less shaded along the middle of the back with blackish; below pure white to the base of the fur. Tail very thinly covered all round with short whitish hairs.

Measurements.—Total length (type), 388 mm.; tail vertebræ, 170; hind foot, 40; ear from anterior base (measured from dry skin), 24. Average of six adult specimens: Total length, 370; tail vertebræ, 155; hind foot, 40.5; ear from anterior base (measured in dry skin), 25.

Skull.—Similar to that of *N. micropus*, but with heavier dentition and the 'sphenopalatine vacuities' very nearly closed.

Type, No. $\frac{7765}{6742}$, ♂ ad., Pendennis, Lane Co., Kansas, May 8, 1894; W. W. Granger.

This species is represented by two adult males, four adult females, and four quarter-grown young, taken on the Smoky River, near Pendennis, Lane County, Kansas, May 8, 1894, by Mr. Walter W. Granger, and also by a single specimen taken at Fort Lyons, Colorado, Feb. 4, 1885, by Capt. P. M. Thorne, U.S.A. This latter specimen, an adult male, is in full winter pelage, and differs from the others only in the upper surface of the tail being more distinctly blackish.

This species agrees very closely in size and proportions with *N. micropus*, but the two species differ widely in coloration, the former being slaty plumbeous above instead of yellowish gray or buffy, as in the Kansas form. Twenty fully adult specimens of *N. micropus* average as follows: Total length, 371 mm.; tail vertebræ, 154; hind foot, 39. In cranial characters the two forms differ mainly in the great reduction of the sphenopalatine vacuities in *N. campestris*, which are narrowed to very fine slits, which in some specimens are as fully closed as in the *N. cinerea* group. The teeth are also rather heavier and broader. The pterygoid notch is very broad anteriorly.

This species is much larger than *N. fallax* Merriam, from Boulder County, Colorado, much less strongly colored, and lacks the peculiar character of M_3, which in *N. fallax* has "3 instead of 2 salient angles on outer side, and 2 reëntrant angles instead of 1." It is evidently much more nearly related to *N. baileyi* Merriam from Valentine, Cherry County, Nebraska, with which it agrees in size and proportions, and of which it may prove to be merely a southern form; but it is strongly buffy instead of "grizzled gray," and has the shorter palate and longer incisive foramen of *N. floridana* and *N. micropus*.[1]

Neotoma rupicola, sp. nov.

Similar in proportions and coloration to *N. campestris*, but much smaller and much paler, with much larger ears and a bushy tail. Above creamy buff, slightly darkened with black-tipped hairs, confined mainly to the middle of the dorsal region; head and face not very distinctly paler; feet and whole lower parts pure white to the base of the hairs; tail bushy, gray above, generally becoming lighter towards the tip, pure white below; ears large, grayish, thinly haired, conspicuously edged with white.

Measurements.—Total length (type), 330 mm.; tail vertebræ, 154; tail to end of hairs, 178; hind foot, 41; ear from notch (27 measured from skin). Average of 14 adults (7 ♂♂, 7 ♀♀): Total length, 336; tail vertebræ, 146; hind foot, 40.

Skull.—In cranial characters *N. rupicola* belongs to the *N. orolestes* group of bushy-tailed Wood Rats, and except in the well-developed sphenopalatine vacuities bears a general resemblance to the '*Teonoma*' section of the genus *Neotoma*.

Type, No. $\frac{8390}{6717}$, ♂ ad., Corral Draw (southeastern base of Black Hills), South Dakota, August 21, 1894; W. W. Granger.

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[1] Material received since the publication of my *N. micropus canescens* shows that it is inseparable from *N. micropus*. It is interesting to note that specimens of *Neotoma* from Fort Lyon, Colorado, and Lane County, Kansas, show no approach in coloration to Oklahoma specimens of *N. micropus*.

Represented by a series of 35 specimens, taken at the southeastern base of the Black Hills, June 7 to August 28, 1894, by Mr. W. W. Granger. It includes immature examples of various ages, from one-fourth grown upward, as well as numerous adults. The seasonal variation is not very strongly marked, but the June and July specimens are rather paler and less strongly buffy than the late August specimens in fresh fall pelage. Very young specimens are pale gray above, slightly varied with dusky hairs on the back. In adults the tail above often lightens toward the tip, where it is sometimes clear white.

This species differs from *N. orolestes*, apparently its nearest ally, in its much paler coloration, smaller size, and relatively much shorter tail.

Neotoma grangeri, sp. nov.

Similar in size and coloration to *N. cinerea*, but with well-developed sphenopalatine vacuities.

Adult in summer : Above gray strongly varied with dusky, the ground color varying from clay color to pale buffy, heavily lined with black hairs ; head darker, purer gray, nearly without any tinge of fulvous ; tail above dusky gray, nearly concolor with the back, pure white below ; feet pure white as far as wrists and ankles ; ears blackish, thinly haired, very narrowly edged with white ; underparts white, in thin summer pelage without plumbeous at base of fur.

Young, a few weeks old (nurslings) : Ashy gray, the middle of the back strongly blackish. *Young*, half-grown : Above slightly washed with pale buff, particularly on the sides, strongly varied with black over the middle of the back, much less so on the sides.

Measurements.—Total length (type), 393 mm.; tail vertebræ, 173 ; tail to end of hairs, 190 ; hind foot, 41 ; ear from notch, 28 (measured from skin). Average of 5 adults (3 ♂♂, 2 ♀♀) : Total length, 381 mm.; tail vertebræ, 163 ; hind foot, 41.

Skull.—Total length, 51 ; basal length, 49 ; greatest parietal breadth, 28 ; least interorbital breadth, 5 ; length of nasals, 19 ; length of incisive foramina, 12 ; length of palate, 9.

Type, No. $\frac{8391}{6718}$, ♂ ad., Custer, Black Hills, South Dakota, August 4, 1894. Collected by Mr. W. W. Granger, for whom the species is named.

This species is represented by 14 specimens taken at Custer, South Dakota, July 25 to August 9, and by two taken at Glendale, Sept. 8, 1894, by Mr. W. W. Granger. Five are fully adult, 6 are 'young adults,' and 5 are young, one-third to two-thirds grown. They are all very dark colored, and form a very uniform series, except one, a very old male, taken Aug. 8, which differs from all the others in having the whole upper parts bright buffy ochraceous, and the tail above very light gray, fading to whitish basally. No other specimen shows any approach to this phase of coloration, although other adults were taken the same day at the same place. This may be an adult in fall pelage, as the coat is much fuller and softer than in any of the others, but the peculiar coloration is possibly due to old age.

N. grangeri is probably merely the Black Hills representative of *N. cinerea* of the Rocky Mountains, from which it differs in having well-developed sphenopalatine vacuities, as in the *N. orolestes* group. It is much larger than *N. rupicola*, and differs from it so totally in coloration at all ages as not to require comparison with it.

These two forms of *Neotoma* are perfectly parallel, in respect to color differences, with the forms of *Sitomys* and *Tamias* occurring at the same localities, the Black Hills affording a dark phase of each, and the adjoining plains at their eastern base a light fulvous phase. Thus on the Plains we have the pale fulvous *T. minimus* in contrast with the dark *borealis* form of the *T. quadrivittatus* group in the Black Hills; in the same way the fulvous *Sitomys americanus nebracensis* contrasts with a Black Hills form closely related to the dark northern *S. a. arcticus;* and the pale fulvous *N. rupicola* of the Plains contrasts with the dark colored *N. grangeri* of the Black Hills.

Sciurus hudsonicus[1] **dakotensis,** subsp. nov.

Sciurus hudsonius var. *hudsonius* ALLEN, Mon. N. Am. Roden. 1877, p. 672 (in part).

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[1] The name *hudsonicus* Erxleben has one year priority over *hudsonius* Pallas, as shown by me in 1877 (Monog. N. Am. Roden., 1877, p. 685), in commenting upon which fact I said: "Following the strict rule of priority, the name should probably be written *hudsonicus* (from Erxleben), this being the first distinctive appellation given to this form, it having apparently a priority of one year over *hudsonius*." I did not then insist upon its adoption, following the rather lax system in such matters then prevailing. The names of the several forms of the Chickaree group of Squirrels should stand as follows:

Sciurus hudsonicus (Erxl.).
Sciurus hudsonicus dakotensis Allen.
Sciurus hudsonicus douglasii (Bachm.).
Sciurus hudsonicus vancouverensis Allen.
Sciurus hudsonicus californicus Allen.
Sciurus hudsonicus fremonti (Aud. and Bachm.).
Sciurus hudsonicus mogollonensis (Mearns).

Paler and more fulvous than *S. hudsonicus*, and much less reddish. Size slightly larger; proportions similar.

Type, No. ——, ♂ ad., Squaw Creek, Black Hills, South Dakota, July 21, 1894; W. W. Granger.

This is the pale form referred to by me in 1877 (l. c., p. 681) as follows: "As already noticed, in the region of the Black Hills, var. *hudsonius* loses much of its redness; the dorsal band becomes less distinct; the middle of the tail is paler; and the edging of the tail is yellowish gray, instead of bright fulvous, or yellowish red as is the case in eastern specimens." A series of 7 specimens collected by Mr. W. W. Granger, in the Black Hills, South Dakota, in July and September, confirm the differences shown by the series examined by me in 1877. It is further to be noted that the black lateral line, usually so conspicuous in eastern examples taken at this season, is either entirely wanting, or only slightly indicated in Mr. Granger's specimens. Probably, as in the case of *Tamias quadrivittatus borealis*, *S. h. dakotensis* is the prevailing form northeastward to Pembina and the Turtle Mountains, as indicated in my Monograph of the Sciuridæ (l. c., p. 692, in Table XIII).

Nyctinomus nevadensis (*H. Allen*).

Nyctinomus macrotis nevadensis H. ALLEN, Mon. N. Am. Bats, 1893 (=1894), p. 171, pll. xxxiv, xxxv ("Nevada and California").

Dr. Harrison Allen has recently described a form of *Nyctinomus* from "Nevada and California" (exact locality not stated), under the name *Nyctinomus macrotis nevadensis*, based on two immature specimens. An examination of these two specimens[1] shows that even the older one of the two (U. S. Nat. Mus., No. $\frac{15178}{36569}$, California, John Mullan) is so young as to still retain the milk incisors in the upper jaw.[2] The very short, thin, unicolor pelage also indicates juvenility. It is therefore of great interest to find in Mr. Price's collection of Arizona mammals a specimen of *Nyctinomus* from the Chiricahua Mountains referable to the same species. It is an adult male, with a well-developed gular sac. It is not only considerably larger than the type of *N. m. nevadensis*, but somewhat larger than the measurements given by Dobson (P. Z. S., 1876, p. 729) for the type of *N. macrotis.* Its resemblance in general features to *N. macrotis* is evidently strong.

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[1] I am indebted to the kindness of Mr. Frederick W. True, Curator of Mammals, U. S. National Museum, for the opportunity of examining these precious specimens. They are preserved in alcohol, but the skulls have been removed and separately preserved. They are labeled as follows: "$\frac{15178}{36569}$, *Nyctinomus macrotis nevadensis*. California. John Mullan." The labels of both the animal and the skull bear the same inscription. The other specimen is merely a skin in alcohol. The label, as nearly as can be deciphered, has on one side "*N. macrotis*, Nevada. 1052"; on the other side, "353. Label in envelope" The California example must obviously be taken as the type of the species, although some of the details of the [illegible] (l. c., pl. xxxiv) appear to have been drawn from the Nevada specimen.

[2] Since the above was put in type I have received from Mr. True the skull of the other specimen (U. S. N. M., No. [illegible]). This skull retains not only the upper milk incisors, but also the upper milk canines, although the permanent canines have cut the gum. The rest of the teeth belong to the permanent set.

Mr. True, in reply to my inquiries, kindly informs me that no information concerning the history of these specimens beyond that furnished by the labels, as above given, is obtainable.

The type of *N. macrotis* Gray (Ann. & Mag. Nat. Hist., IV, 1839, p. 5) came from the interior of the island of Cuba. According to Dobson (l. c.) it was a female, and appears to have been unique up to the date of Dobson's 'Catalogue of the Chiroptera,' published in 1878. Dobson, however, refers to *N. macrotis* various species described by other authors, from southern Brazil and Paraguay. As it has not been reported from either Mexico or Central America the probability, on geographical grounds, is therefore strongly against the occurrence of the true *N. macrotis* in Arizona, California, or Nevada, aside from the various discrepancies in the structure of the ears, etc., already pointed out by Dr. H. Allen as existing between *N. macrotis* and his *N. m. nevadensis.* Between the Arizona and California specimens, however, there are no differences that might not easily result from the great difference in the age of the specimens. In the California and Nevada specimens the pelage is short, thin and unicolor from base to tip, as is usually the case in young Bats in first pelage. In the older (California) example the second growth of hair appears to be coming in in patches on the chest.

In raising *N. macrotis nevadensis* to full specific rank the detailed account already given by Dr. Allen of the young may be supplemented by the following description of an adult male :

Adult Male.—Structure of the ears, membranes, etc., as already given for the young (*cf.* H. Allen, l. c.). Pelage above dull brown, slightly rufescent. the basal half whitish ; below similar, but rather lighter.

Measurements.—Total length, 140 ; alar expanse, 410 (collector's measurements from the fresh specimen). The following are from the skin : Forearm, 58 ; 2d digit, metacarpal, 60 ; 3d digit, metac., 58, 1st phal., 23, 2d phal., 20, 3d phal., 8 ; 4th digit, metac., 53, 1st phal., 48, 2d phal., 2.5 ; 5th digit., metac., 27, 1st phal., 20, 2d phal., 3 ; tibia, 16 ; foot, 10 ; tail, 63, free portion of same, 34. (The measurements of the tail are only approximate, and are possibly too large, as the tail has the appearance of having been pulled out too long.) Height of ear, 24; width of same, 36.

Skull.—Total length, 23; basilar length, 21; zygomatic breadth, 12.5; mastoid breadth, 11.5; least interorbital breadth, 6; length of lower jaw, 16; height of same at coronoid, 3.5. The skull (including dentition) is in general as described by Dr. Allen, except that it is larger and heavier, with the sagittal crest continued to the occipital, and there is less depression at the junction of the frontal anal parietal segments. All the processes are heavier, as would be expected in an old skull.

Type of the above description, No. $\frac{8414}{6740}$, ♂ ad., Chiricahua Mountains, June 22, 1894; W. W. Price and B. C. Condit.

As already noted, there is a well-developed gular sac, which is said to be wanting by Dr. Dobson in both *N. macrotis* and the smaller *N. gularis*; but Dr. Dobson's specimen of *N. macrotis* was a female, and this is a feature which varies with sex and age in the same species of both *Nyctinomus* and *Molossus*.

Arvicola (Pedomys) haydenii *Baird.*

Arvicola (*Pedomys*) *haydenii* Baird was described from a single specimen from Fort Pierre, South Dakota, on the Missouri River, about 150 miles directly east of the Black Hills. In the Granger collection I find a single specimen, an adult female, of the subgenus *Pedomys*, taken on Spring Creek, at the eastern base of the Black Hills, June 22, 1894. This specimen is evidently a little larger and a little grayer than Baird's type, but agrees with it so closely, especially in the dimensions of the skull and in the peculiarities of dentition, that I have little hesitation in referring it to *A. haydenii*. Baird's description of the cranial and dental characters, as well as of the external appearance, of his *A. haydenii* is so detailed that I find little to add from the basis of the present specimen. It is, however, obviously grayer—gray mixed with black, very slightly tinged with yellowish brown, rather than yellowish brown washed with gray. Mr. Granger's measurements from the fresh specimen are as follows: Total length, 183; tail vertebræ, 45; hind foot, 25. The corresponding measurements given by Baird for his type are: Total length, 152; tail vertebræ, 38; hind foot (from dry skin), 20.5. But there is much less difference in the measurements of the skulls, which compare as follows: Black Hills specimen—total length, 30; zygomatic breadth, 17; nasals, 9; upper molar series, 7. Type of *haydenii*—total length, 29; zygomatic breadth, 16.5; nasals (not given); upper molar series, 6.4. Hence the difference in external measurements is obviously more apparent than real.

Since writing the above I have received, through the kindness of Mr. True, the type of *haydenii*, an examination of which confirms the opinion above given of the relation of *haydenii* to Mr. Granger's Black Hills specimen. Baird's type appears to have been originally an alcoholic, and to this fact may be due in part the more yellowish cast of color it presents in comparison with the Black Hills specimen.

Three other Nebraska specimens are mentioned by Dr. Coues as referable to either "*austerus*" or to "*austerus curtatus*." These have also been kindly sent to me for examination by Mr. True. Says Dr. Coues (l. c., p. 212): "A Platte River specimen (No. 3094) is identical with the type of '*haydeni*.'" This specimen is labeled "♂, Crossing of Platte, July 8, '57. Wm. S. Wood." On the back of his label Dr. Coues has written, "Exactly like '*haydeni*.'" With this opinion I heartily concur. Another specimen (U. S. N. M., No. 3055) is referred to *curtatus*. but with the remark (l. c., p. 216): "In color, almost exactly like the paler 'haydeni' stripe of *austerus* ; . . . ." On the label is written "Platte R. (320 m. fr. Ft. Riley). Dr. W. A. Hammond." This would bring the locality in western Nebraska, about 100 miles south of the Black Hills. In coloration and size it very closely resembles the Granger specimen above recorded. These specimens indicate the extension of the range of *Arvicola haydenii* from Fort Pierre and the Black Hills southward to the North Platte River in western Nebraska.

The third specimen (U. S. N. M., No. $\frac{3241}{12117}$), collected by Dr. F. V. Hayden on Lieut. (later Gen.) G. K. Warren's Exploration of the Upper Missouri and Yellowstone, is without locality on the original label, but on a later label is credited to "Nebraska"; it was probably taken somewhere in what is now North Dakota.

It was referred by Coues to his *curtatus*. It is much smaller and somewhat paler than the others (except No. 3055), and is apparently referable to *Arvicola austerus minor* Merriam, with which it agrees closely in size and dentition.

Mr. True has also sent to me for examination what remains (the skull only) of Baird's type of his *Arvicola* (*Pedomys*) *cinnamomeus*, which demands consideration in the present connection, since this name has priority of two pages over his *A. haydenii*, in case the two should prove the same.

Arvicola (Pedomys) cinnamomeus *Baird.*

This species was based on a single specimen from Pembina, North Dakota, of which only the skull is now extant. According to Baird, it bears a close resemblance in external characters to *A. austerus*, from which it was separated in part on peculiarities of dentition, which both Dr. Coues[1] and Dr. Merriam[2] consider to be probably abnormal. After an examination of the skull, however, I find myself unable to share this opinion. In addition to the unusual character of the enamel folds of the last upper molar, as noted by Baird, there is the great length and narrowness of the whole skull, and particularly of the rostral portion, as correctly stated by Professor Baird. He also refers to the large size of the Pembina specimen, in comparison with typical (Illinois) examples of *austerus*, the greater length of the tail, the larger size of the nail on the thumb, and the smaller ears—features now impossible to verify, in consequence of the destruction of the skin. The skull, however, sufficiently substantiates the large size, and there is no good reason to question Baird's statements respecting the other differences.

I have no Illinois or Wisconsin examples of *A. austerus*, but the Museum has a large series from Fort Snelling, Minnesota (Dr. E. A. Mearns Collection). The largest skull of this series (probably referable to *A. austerus minor* Merriam) is not more than half the size of the Pembina specimen, which differs besides in numerous important cranial details. It is also to be noted that the form of *austerus* occurring over the region to the southeastward of Pembina is much smaller than typical *austerus* from much further south (*cf.* Merriam, Am. Nat., July, 1888, pp. 600, 601). It hence seems reasonable to consider Baird's *cinnamomeus* as distinct from any known form of the *austerus* group, and also from *A. haydenii.* Doubtless further material from the vicinity of Pembina will, sooner or later, firmly reëstablish the species.

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[1] Mon. N. Am. Roden., 1877, pp. 212, 213, 217.

[2] Am. Nat., July, 1888, p. 601.

In connection with the discovery of *Arvicola* (*Pedomys*) *haydenii* at the eastern base of the Black Hills, as chronicled above, it is of interest to note that Dr. Coues has also recorded (Mon. N. Am. Roden., 1877, pp. 216, 217) an alleged specimen of *Pedomys* from the "Black Hills" (U. S. Nat. Mus., No. 3056), taken in August, and considered as probably "a young of the year." He comments at length upon its many peculiarities, as its "extremely short" tail, whitish feet, and excessively pallid coloration. As the skull was enclosed within the skin, he appears to have made no examination of its dentition. This specimen, from which the principal parts of the skull have since been removed, is now before me. It proves not to be a *Pedomys* at all, but an undescribed species of the genus *Phenacomys*, which may be briefly characterized as follows :

Phenacomys truei, sp. nov.

Above similar in coloration to *Arvicola* (*Chilotus*) *pallidus*, but rather darker, especially over the median dorsal region, where the general pale grayish tint of the upper parts is slightly varied with dusky hairs ; below whitish gray, the basal half of the fur plumbeous. Ears of average size for the genus, thinly haired ; feet light or whitish gray ; tail very short, dingy gray, slightly darker above, but not distinctly bicolor, with a slight terminal pencil.

Measurements.—The fragmentary condition of the skin gives so poor a basis for measurement that I copy the dimensions as recorded by Dr. Coues[1] : Total length, 118 ; head and body, 101.6 ; tail vertebræ, 16.8 ; hairs at tip, 3.5 ; fore foot, 11.2 ; hind foot, 19 ; ear, 10.2 (all taken from the dry skin).

Skull.—The skull consists merely of fragments, roughly torn out of the skin. The parts available for study are the palatal portion with the molar teeth in place, and the greater part of both mandibular rami, including the teeth. The tooth pattern, while distinctively that of *Phenacomys*, differs in various details from that of any of the hitherto described species of the genus. *Upper Molars.*—M^1 with a broadly rounded anterior loop, two internal closed triangles, and two external closed triangles ; M^2 with an anterior internal pyriform loop, two external and one internal triangles ; M^3 with three deep internal triangles and three very slight angular projections externally. *Lower Molars.*—M_1 with an anterior trefoil, a transverse posterior loop, and three large internal and two small external closed triangles ; M_2 with a posterior transverse loop, two very deep, closed internal triangles, and two very slight external angles ; M_3 with three very deep internal triangles and an outer sinuous border. Length of upper molar series, 6 mm.; of lower molar series, 5.5 mm.

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[1] Monog. N. Am. Roden., 1877, p. 217, Table LV, specimen No. 3056. The measurements were given by Dr. Coues in inches and hundredths.

Type, U. S. Nat. Mus., No. 3056, Black Hills, Aug. 10, 1857 ; Dr. W. A. Hammond.

Named for Mr. Frederick W. True, Curator of Mammals, U. S. Nat. Mus., to whose kindness I have been many times greatly indebted for valued assistance.

The specimen upon which the above description is based is apparently full grown but quite young, as the molars are not rooted, as they become later in life in this genus. In young individuals they are only partly so[1] or not at all, as in the present specimen.

In coloration *Phenacomys truei* is much lighter than *P. orophilus* Merriam from Idaho, lacking almost entirely the abundant black-tipped hairs which in that species strongly tinge with blackish the whole median dorsal region.

The dentition of *P. truei* is peculiar in the slight development of the external triangles of all the molar teeth, both above and below, in comparison with the other described species. M_1 closely resembles the corresponding tooth in *P. latimanus*, while M_3 closely resembles M_3 in *P. intermedius*.

The discovery of a species of *Phenacomys* in the Black Hills greatly extends the known range of the genus to the southward, east of the Rocky Mountains. *P. orophilus* was described from specimens collected in the mountains of south-central Idaho, but there is a hitherto unrecorded specimen of this species in this Museum from St. Mary's Lake, northwestern Montana, collected by Dr. George B. Grinnell. This is the nearest point to the Black Hills from which *Phenacomys* has been thus far reported.

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[1] *Cf.* Merriam, N. Am. Fauna, No. 5, 1891, p. 66.

Article XIV.—REMARKS ON CERTAIN LAND MAMMALS FROM FLORIDA, WITH A LIST OF THE SPECIES KNOWN TO OCCUR IN THE STATE.

By FRANK M. CHAPMAN.

During the past five years the Museum has received several collections of small mammals from Florida, containing in all about 400 specimens. They were collected for the most part at Gainesville and on the East Peninsula, opposite Micco, by the writer; at and near Micco by the late Jenness Richardson; at Tarpon Springs by W. E. D. Scott, and at Enterprise and Flamingo, near Cape Sable, by C. L. Brownell. The last-named collection has recently been received. It contains material worthy of special note, and in working this up for publication several facts of interest in connection with species represented in the other collections have been developed. These refer to so large a proportion of the land mammals of Florida that it has been decided to include all the species known from the State. The list as a whole is based on the collections above mentioned, information furnished me by friends and associates, and the following previously published lists of Florida mammals: (1) 'On the Mammals and Winter Birds of East Florida,' etc., by Dr. J. A. Allen (Bull. Mus. Comp. Zoöl., II, 1871, pp. 168–185), an annotated list of 34 species. (2) 'Catalogue of the Mammals of Florida, with Notes on their Habits, Distribution,' etc., by C. J. Maynard (Bull. Essex Inst., IV, 1872, pp. 135–148), an annotated list of 36 species. (3) 'The Mammals of Florida,' by C. J. Maynard (Quart. Journ. Boston Zoöl. Society, II, 1883, pp. 1–8, 17–24, 38–43, 49, 50), an annotated list of 36 species, containing much the same matter as the paper just cited. (4) 'Contributions to the Mammalogy of Florida,' by Samuel N. Rhoads (Proc. Acad. Nat. Sci., Phila., 1894, pp. 152–160), containing remarks on 22 species.

1. **Didelphis marsupialis virginiana** (*Kerr*). Common Opossum.—Abundant throughout the State.

2. **Cariacus virginianus** (*Bodd.*). Virginia Deer.—Abundant in the less-settled portions of the State, and occurring in small numbers in the vicinity of the larger towns and cities. Proper material will doubtless show that Florida deer constitute a well-marked subspecies, distinguished chiefly by their small size.

3. **Sciurus carolinensis** *Gmel.* Southern Gray Squirrel.—A common and, in places, an exceedingly abundant animal throughout the 'hummocks' of the State. A perfectly black specimen, collected by W. E. D. Scott, at Tarpon Springs, is the only melanistic individual I have seen.

4. **Sciurus niger** *Linn.* Southern Fox Squirrel.—Of general distribution throughout the pineries, but is common only locally. In one of eight specimens the black of the head extends half-way down the back.

5. **Sciuropterus volucella** (*Gmel.*). Flying Squirrel.—Common in some parts of the State, living in the live-oaks of the 'hummocks,' and in turkey-oaks in the pineries.

6. **Castor canadensis** *Kuhl.* Beaver.—During a two-days' stay at Marianna in western Florida, in March, 1889, Mr. William Brewster secured reliable information concerning the occurrence of the Beaver in some numbers on Chipola River. Mr. Brewster did not see specimens or signs of the animal during his brief visit, but the character of the testimony he received was such as to place its presence beyond question. I have information also of the occurrence of the Beaver in southern Alabama.

7. **Arvicola (Neofiber) alleni** (*True*). Florida Round-tailed Muskrat.—Doubtless a common animal in favorable localities throughout the State. It is abundant on the savannas of the East Peninsula of Indian River (*cf.* this Bulletin, II, 1889, p. 119); it is not uncommon near Gainesville, and Mr. Brownell's collection contains a specimen taken at Enterprise.

In a paper by Mr. F. W. True on the relationships of this species (Report of the Smithsonian Institution for 1884, Part II, pp. 325–330, pl. ii), it is, I think, clearly shown that the characters upon which the genus *Neofiber* was based are of not more than subgeneric value.

The Muskrat (*Fiber zibethicus*) is abundant along the coasts of southern Mississippi and Alabama, and doubtless occurs in western Florida.

8. **Arvicola pinetorum** (*Le Conte*). PINE MOUSE.—Known from Florida only through Audubon and Bachman's record. It is probably restricted to the extreme northern portions of the State.

9. **Oryzomys palustris natator** *Chapm.* FLORIDA MARSH RAT.—The Museum possesses a fine series of this strongly-marked race from Gainesville, Enterprise, Micco and Flamingo.

10. **Sitomys aureolus** (*Wagn.*). GOLDEN MOUSE.—Two specimens of this species are recorded from Dummitt's by Mr. Maynard, and the Museum has two specimens from Gainesville, presented by Mr. J. Robertson. They agree with examples from North Carolina.

11. **Sitomys americanus gossypinus** (*Le Conte*). DEER MOUSE; HUMMOCK MOUSE.— Exceedingly abundant. The Museum collection contains a series of some eighty specimens of this well-marked subspecies. Of this number twenty-nine are adults with worn molars. They were taken at Gainesville, Enterprise and Micco, from February to April. Twenty-two examples, representing each of the localities mentioned, are typical *gossypinus*, with dark, blackish median dorsal area and fulvous sides. Two specimens from Micco exhibit a distinct *rufous phase*, in which the entire upper parts are almost as uniformly golden rufous as are the same parts in *Sitomys aureolus;* indeed, at first sight these two specimens would be taken for *aureolus* rather than *gossypinus*. Seven specimens, from Gainesville, Enterprise and Micco, are variously intermediate between the rufous and the dark phase of pelage, connecting one with the other by a finely graded series of changes.

Mr. S. N. Rhoads has kindly sent me the type of his recently described *Sitomys megacephalus*[1] from Alabama, and with it two specimens of *Sitomys* from Pasco County, Florida, which he has provisionally referred to that species. In my opinion these specimens are examples of *S. a. gossypinus.* There are specimens in my series of the latter form which practically match them, both in size and color. The average measurements of 14 adult males of *S. a. gossypinus* are: total length, 179; tail, 73 mm. Six females average: total length, 186; tail, 74 mm. The type of *S. megacephalus* measures, total length, 184; tail, 81 mm. The two specimens from Pasco County measure, respectively, No. 1660, ♀, total length, 203; tail, 76 mm.; No. 1702, ♂, total length, 175; tail, 75 mm. The cranial measurements in the appended table doubtless show the relative sizes of these specimens with more exactness.

	Sex.	Total length.	Orbital constriction.	Nasals.	Incisors to post-palatal notch.
S. megacephalus.					
3535.[2] Alabama......	♀	30	4.5	11.5	11.5
S. a. gossypinus.					
1702.[3] Pasco Co., Fla.	♂	28.2	4 3	10.5	11
1198.[4] Citrus Co., Fla.	♂	29.5	4.5	11.5	11.5
691. Gainesville, Fla.	♀	28.1	4.7	11	11
1053. " "	♂	28.1	4.2	11	11.5
1073. Micco, Fla.....	♂	28	4.3	10	10.2

The type of *S. megacephalus* apparently resembles *S. a. gossypinus* in coloration, and while I believe it to be a distinct form, it is obviously so closely related to *gossypinus* that a discussion of its characters based on one alcoholic specimen would be premature.

12. Sitomys floridanus (*Chapm.*). Big-eared Deer Mouse.

Hesperomys floridanus Chapman, Bull. Am. Mus. Nat. Hist. II, 1887, p. 117.
Hesperomys macropus Merriam, N. A. Fauna, No. 4, 1890, p. 53.

Seven adults from Enterprise, the type of *macropus* from Lake Worth, loaned me by Dr. Merriam, an immature specimen from the Indian River, loaned me by Mr. G. S. Miller, Jr., and one adult and one immature specimen from Citronelle, loaned me by Messrs. Miller and Bangs, form a series which clearly shows the relationship of *floridanus* to *macropus*. Briefly, the type of *macropus* is apparently a fully adult example of *floridanus*. *S. floridanus* was described from a nursing female, the skull of which had been lost, taken by Mr. James P. H. Bell, at Gainesville. The immature specimens in the collections of Messrs. Miller and Bangs show that this type is in the gray pelage of the almost fully grown young. A tawny or fulvous line on the sides of the type shows it is changing from the immature to adult pelage. Citronelle is about forty miles southwest of Gainesville. The immature specimen from that locality is younger and therefore somewhat grayer than the type of *floridanus*, and the fulvous line on the sides appears only faintly, and on the anterior parts of the body. The adult specimen from Citronelle agrees essentially with the type of *macropus*, which the seven adults from Enterprise also resemble. The immature specimen from Indian River, however, in Mr. Miller's collection is practically a duplicate of the type of *floridanus*. It is evident, therefore, that only one species is represented in this series, to which the older name *floridanus* must be applied.

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[1] Proc. Acad. Nat. Sci., Phila., 1894, p. 254.

[2] Coll. Phila. Acad.

[3] Coll. S. N. Rhoads.

[4] Coll. Miller and Bangs.

There is little to add to Dr. Merriam's description of this species. The pectoral spot mentioned by him as present in the type of *macropus* is shown by the type of *floridanus*, but by no other examples in my series. An apparently constant cranial character is found in the shape of the posterior portion of the palate, which rises at a slight angle from the palatine foramina, and has its thickened margin surmounted by two small, but evident rounded processes.

13. Sitomys niveiventris (*Chapm.*). GROUND MOUSE.—An abundant species on the coast of the East Peninsula, living on the ground beneath the scrub palmettoes near the sea.

14. Sitomys niveiventris subgriseus *Chapm.* OLD-FIELD MOUSE.—This is a darker form of the preceding, inhabiting the interior. It is abundant in fields, both cultivated and abandoned.

Some account of its habits and relationships will be found in this Bulletin, Vol. V, 1893, p. 340.

Specimens from Tarpon Springs, in Mr. Rhoad's collection, are intermediate between *niveiventris* and *subgriseus*. (*Cf.* Rhoads, l. c., p. 160).

15. **Reithrodontomys humilis** *Aud. & Bach.* Harvest Mouse.—Mr. Brownell's collection contains an immature specimen of this species from Enterprise. It was previously known in Florida from only one specimen taken at Tarpon Springs. (*Cf.* Rhoads, l. c., p. 161.)

16. **Sigmodon hispidus** *Say & Ord.* Cotton Rat.—An exceedingly abundant animal, of general distribution in the northern parts of the State. Say and Ord's type came from the St. John's River, doubtless from the vicinity of Jacksonville. A series from this locality in the Museum of Comparative Zoölogy at Cambridge agrees with a series from Gainesville. They differ widely from the more southern *littoralis*, and are obviously to be placed with South Carolina specimens, though, as might be expected, they are to some extent intermediate between these two extremes.

17. **Sigmodon hispidus littoralis** *Chapm.* South Florida Cotton Rat.—The Museum contains a fine series of this well-marked subspecies from Enterprise, Micco, Pine Island and Flamingo. Thirteen specimens from the last-named locality, as a series, present appreciable differences from other series taken at Enterprise and Micco. They are grayer and have a rufous tinge on the rump. In some respects they suggest *Sigmodon h. texianus*. These differences are, however, in my opinion, too slight to warrant the separation of a Gulf coast race. A specimen of *Sigmodon* from Pine Island, mentioned by me in a former paper, is apparently an aged adult in unusually gray pelage.

18. **Mus decumanus** *Pallas.* Norway Rat; Brown Rat.—This species is given by all previous writers on Florida mammals. I have never met with it in Florida.

19. **Mus alexandrinus** *Geoff.* White-bellied Roof Rat. —In my experience this is the common House Rat of Florida.

20. **Mus rattus** *Linn.* BLACK RAT.—This species appears not to have previously been recorded from Florida. Mr. Brownell's collection contains four specimens taken at Enterprise.

21. **Mus musculus** *Linn.* HOUSE MOUSE. — Abundant in settled parts of the State. New dwellings in unsettled localities are at first tenanted by the native Deer, or Hummock Mouse, but, in time, they are replaced by this omnipresent pest.

22. **Neotoma floridana** *Say & Ord.* WOOD RAT. — Of general distribution in the hummock-grown portions of the State, but, in my experience, it is nowhere a common species.

23. **Geomys tuza** (*Ord*). FLORIDA GOPHER ; SALAMANDER. —An exceedingly abundant animal throughout those portions of the State which are, or were, grown with pines with an undergrowth of turkey-oaks—land of the poorest quality. In some parts of middle Florida I believe one could walk for miles stepping from mound to mound on the earth thrown up by this active miner.

There exists a puzzling confusion in regard to the common name of this species. To naturalists it is known as Gopher, or Pocket Gopher, a name generally applied to its congeners by every one familiar with them. The 'Gopher' in Florida, however, is a large land-tortoise (*Xerobates polyphemus*), which lives in large burrows in the ground, frequenting the same localities as those in which *Geomys* is found.

In a series of twenty-six specimens, six, taken in January, October and December, at Gainesville and Tarpon Springs, appear to represent a rufous phase of pelage. The remaining twenty show little variation in color.

24. **Lepus sylvaticus** *Bach.* GRAY RABBIT ; 'MOLLY COTTONTAIL.'—An exceedingly abundant species, commonly frequenting plantations and 'old-fields.'

25. **Lepus sylvaticus floridanus** *Allen.* SOUTH FLORIDA RABBIT ; 'MOLLY COTTONTAIL.'—A slightly darker form of the preceding species, inhabiting the southern parts of the State.

26. Lepus palustris *Bach.* MARSH RABBIT; 'HUMMOCK RABBIT.'—An abundant animal in the marshes and lowlands, at least as far south as Gainesville in the interior, but probably not so far south on the coasts. It is replaced in the southern parts of the State by the closely-related *L. p. paludicola.*

27. Lepus palustris paludicola (*Miller & Bangs*). MARSH RABBIT; 'HUMMOCK RABBIT.'—A series of nineteen Marsh Rabbits from Gainesville, Enterprise, Micco, Tarpon Springs and Flamingo furnishes material to more definitely establish the range and relationships of the Rabbit recently described by Messrs. Miller and Bangs[1] from the Gulf coast of Citrus County as *Lepus paludicola.* As these authors remark, and as this series proves, *palustris* and *paludicola* "show no differences in color that might not readily intergrade." Thus while *paludicola averages* darker than *palustris*, a specimen from Flamingo is but little darker than one from Summerville, South Carolina. The characters on which the new race stands, therefore, are rather those of size and proportions than color. The appended tables show a gradual decrease in size from the north southward. A comparison of the extremes shows differences worthy of recognition, but the two forms so obviously intergrade that it is evident that the southern one can claim only subspecific rank.

MEASUREMENTS FROM THE SKIN.

	No.	Sex.	Total length.	Hind foot.	Ear from notch.
North Carolina[2]...............	...	..	435	96	60
South Carolina[3]...	....	..	....	87	55
Summerville, So. Carolina.....	1410	♀	....	85	54
Gainesville, Fla..............	2793	..	440	83.5	51
" "	5650	..	430	90	48
" "	2794	♀	455	88	53
" "	2792	♀	450	90	48
" "	2795	♂	450	89	50
" "	2796	♂	450	86	50
Enterprise, "	....	♀	....	82.5	50
Micco, "	1893	♀	400	78	44
" "	1892	♂	420	78	45
" "	1893	♂	400	83	45
Tarpon Springs, Fla..........	2716	..	....	79	45
" " "	2718	..	....	82	44
Flamingo, "	....	♂	....	79	45

[1] Proc. Biol. Soc. Wash. IX, 1894, p. 105.

[2] Average of two males by Miller and Bangs.

[3] Average of two females by Miller and Bangs.

MEASUREMENTS FROM THE SKULL.

	No.	Sex.	Basilar length.	Length of Nasals.	Width of Nasals.	Length of Incisive Foramen.	Width of Incisive Foramen.
North Carolina[1]	....	..	69	33	12.5	19	7
South Carolina[2].	....	..	67	32.5	13	18	7.5
Summerville, So. Car.	1410	♀	66	31.5	14.2	18.2	6.5
Gainesville, Fla.	1409	..	67	32	13.7	19	7
" "	1411	♂	65	33	13.8	18	7.8
" "	1412	♀	68	32	13.3	19	7
" "	1414	♀	68	33	13	18	8
" "	1415	..	69	30.5	13.1	19	7.3
Micco, "	1158	♀	60	27.5	11.5	16	7
" "	1157	♂	63	28.1	14.1	15.2	6.5
" "	1159	♂	62	28	12	16.5	7.2
Tarpon Springs, Fla.	2190	♂	62	29	13	16	7
" " "	2193	♂	63	30.5	13.2	17	7
" " "	2191	..	63	28	11.2	16	6.5

28. **Artibeus carpolegus** *Gosse.* LEAF-NOSED FRUIT BAT.

Artibeus perspiccillalune [sic] MAYNARD, Bull. Essex Inst. IV, 1872, p. 144; Journ. Bost. Zoöl. Soc. II, 1883, p. 22.

Artibeus perspicillatus H. ALLEN, Bats of North America, 1893, p. 43 (exclusive of synonyms).

Mr. C. J. Maynard obtained a single specimen of *Artibeus* at Key West, which was identified by Dr. Harrison Allen, from sketches, as *Artibeus perspicillatus.* There can be little doubt that this specimen was of the same species as the *Artibeus* so abundant in Cuba, of which the Museum possesses a series of 50 specimens. Since writing of these Cuban bats and referring them provisionally to *A. perspicillatus,*[3] I have secured in Trinidad six adult specimens of what I consider true *Artibeus perspicillatus.* It requires only the most superficial comparison to show that the Cuban bats are unmistakably distinct from the Trinidad species. They are much smaller, as the appended measurements show, and the facial streaks are wanting or nearly obsolete, while the Trinidad species has *four conspicuous* facial streaks which in life are plainly observable at a distance of forty feet or more. Five females from Trinidad average: forearm, 68; thumb, 12; 3d finger, metacarp., 67, 1st phal., 24, 2d phal., 38; tibia, 26.

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[1] Average of two males by Miller and Bangs.

[2] Average of two females by Miller and Bangs.

[3] *Cf.* this Bulletin, IV, 1892, p. 317.

Five females from Cuba average: forearm, 54; thumb, 11; 3d finger, metacarp., 53, 1st phal., 17, 2d phal., 28; tibia, 23.

The Cuban bats agree with specimens from the West Indies identified by Dr. J. A. Allen as *Artibeus carpolegus*, under which name Mr. Maynard's record should apparently stand.

It is doubtful if this species is more than an accidental visitant in Florida. Mr. Maynard speaks of seeing high-flying bats which he supposed were the same as the specimen brought him, but *Artibeus* is a forest-inhabiting, fruit-eating bat, and is rarely observed in the open even in localities where it is abundant.

29. **Corynorhinus macrotis** (*Le Conte*). BIG-EARED BAT.—In his 'Bats of North America,' p. 58, Dr. Harrison Allen records a specimen of this species from Micanopy, Florida.

30. **Vespertilio gryphus** *F. Cuv.* LITTLE BROWN BAT.—This species is included by Mr. Rhoads on the basis of "several specimens" from Tarpon Springs.

31. **Adelonycteris fuscus** (*Beauv.*) BROWN BAT.—Common.

32. **Vesperugo carolinensis** (*Geoff.*). CAROLINA BAT.—I found this to be an abundant species on the Suwanee River, as it doubtless is in other parts of the State.

33. **Nycticejus humeralis** *Raf.* TWILIGHT BAT.—Recorded by Dr. Allen and Mr. Rhoads.

34. **Dasypterus intermedius** (*Peters*). FULVOUS BAT.—In his 'Bats of North America' (1893, p. 138), Dr. Harrison Allen records a specimen of this species from Davenport, Florida, in the collection of Mr. G. S. Miller, Jr.

35. **Atalapha borealis** (*Müll.*) [= *A. noveboracensis* Auct.]. RED BAT.—Ten alcoholic specimens from Gainesville and the Suwanee River are, as has been before remarked of Florida specimens of this species, more "intensely" colored than northern examples. That is they are browner and darker. The Cuban

form, to which, without having seen specimens, Mr. Rhoads refers bats from Tarpon Springs, is, on the contrary, much lighter and brighter in color than true *borealis*.

36. **Atalapha cinerea** (*Beauv.*). Hoary Bat. — The Museum has received one specimen of this species from Mr. J. H. P. Bell, of Gainesville, taken in the vicinity of that city in February, 1891. It agrees with northern specimens, and is the first record of this species from Florida.

37. **Nyctinomus brasiliensis** *Is. Geoff.* House Bat.— Abundant.

38. **Blarina brevicauda carolinensis** (*Bach.*). Southern Mole Shrew.—A single specimen has been recorded by Mr. Maynard from Miami, and I have taken one at Gainesville.

39. **Blarina cinerea** (*Bach.*). Cinereous Shrew Mole.— "A badly-preserved specimen in alcohol from Indian River" is provisionally referred by Prof. Baird to this species.

40. **Blarina exilipes** *Baird.* Small-footed Shrew Mole. —One perfect specimen and one skull found in the stomach of a Barn Owl (*Strix pratincola*) taken at Gainesville, have been identified by Dr. Merriam as the above-named species.

41. **Scalops aquaticus australis** *Chapm.* Florida Mole. —Common. Three examples from Enterprise are typical of this race.

Concerning the status of *Scalops parvus* Rhoads,[1] Mr. F. W. True, who, while preparing his forthcoming monograph of the Talpidæ, has the types of both *S. parvus* and *S. a. australis* in his possession, writes me: " I have no Moles from western Florida except the type of *S. parvus*. All the characters given by Mr. Rhoads are found with greater or less distinctness in specimens from central and eastern Florida and the Carolinas, except perhaps that relating to the form of the *foramen magnum*. There is an approximation to this also. The characters drawn from the teeth are perhaps of little value, as the teeth are very much worn and in a peculiar manner, which gives the impression that the type was an individual kept in confinement for some time. I cannot satisfy myself that this specimen is anything more than a rather small (though adult) *australis*. It is possible, of course, that with a series at command, this view may prove invalid. In my MS. I have placed the species with a query under your subspecies *australis*, and so I shall leave it until new evidence is produced."

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[1] Proc. Acad. Nat. Sci. Phila., 1894, p. 157.

42. **Ursus americanus** *Pall.* BLACK BEAR.—Common in the less-settled parts of the State, particularly along the coasts, which it frequents to feed on the eggs of sea-turtles.

43. **Procyon lotor** (*Linn.*). RACCOON.—Abundant.

44. **Lutra canadensis** (*Schreber*). AMERICAN OTTER.—Generally common.

45. **Mephitis mephitica** (*Shaw*). COMMON SKUNK.—The exact distribution of the two species of Skunks which occur in Florida seems not to be known. This species is common at Gainesville, and, as far as I know, is the only one found there. Dr. Allen gives it as common on the lower St. John's, and Mr. Maynard remarks that it seems to be restricted to the more northern parts of the State.

46. **Spilogale putorius** (*Linn.*). LITTLE STRIPED SKUNK. —This is a common animal in the coast region of eastern Florida, especially in the 'scrub' of the East Peninsula. Dr. Merriam mentions a specimen from Kissimmee Prairie (N. A. Fauna, No. 4, 1890, p. 7), but I know nothing of its status in other parts of the State.

47. **Lutreola vison** (*Schreber*). MINK.—This species is included by Dr. Allen, on the authority of Mr. G. A. Boardman, as "not common." Mr. Maynard mentions seeing one at Blue Springs, and says it was "very plenty on the coast near Cedar Keys."

48. **Putorius erminea** (*Linn.*). COMMON WEASEL.—The Museum has received from Mr. J. H. P. Bell, of Gainesville, one specimen of this species (which has not previously been recorded from Florida) from Osceola. The skull is missing. The skin is more thinly furred than in northern examples; the color of the underparts is more sharply defined from and extends farther up the sides. The fore feet are white, the fore legs white on the under surface. There is a narrow white line along the outer border of the hind legs, and the hind toes are white above and below.

49. **Putorius peninsulæ** *Rhoads.* FLORIDA WEASEL.—Known only from the type specimen taken in Pasco County (*cf.* Rhoads, Proc. Acad. Nat. Sci. Phila., 1894, p. 152).

50. **Urocyon cinereo-argenteus** (*Müll.*). [= *U. virginianus* Auct.]. GRAY FOX.—Common.

51. **Canis lupus griseo-albus** (*Linn.*). GRAY WOLF.—The Wolf in Florida is now on the verge of extinction. The most recent record of its capture, of which I have any knowledge, is based on a skin purchased in Jacksonville three or four years ago by Mr. George A. Boardman. Mr. Boardman writes me: "It was killed down in Lee County, and was black as a bear. I have seen as many as half-a-dozen skins and parts of skins, and most all were black. There were no light ones such as we have north, but one or two were reddish black, lighter on the belly. The hair of all was quite short, and with no fine under-hair as in the northern wolf."

52. **Felis concolor** *Linn.* PUMA.—Confined to the less-settled portions of the State, where it is not uncommon.

53. **Lynx rufus floridanus** (*Raf.*).[1] FLORIDA WILD CAT.—Common in most parts of the State. In Brevard County (and also other counties) a bounty was offered for scalps of this animal, which resulted not only in bankrupting the county treasury

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[1] *Cf.* Allen, this Bulletin, V, 1893, p. 32

but in so great an increase of Rabbits as to threaten destruction to the crops of vegetable growers.

From many sources I have received information of the occurrence in Florida of a long-tailed, spotted Wild Cat, which may prove to be the Ocelot (*Felis pardalis*).

Article XV.—DESCRIPTIONS OF FIVE NEW NORTH AMERICAN MAMMALS.

By J. A. Allen.

As some time must elapse before the publication of the final reports on the Granger and Price Collections of Mammals, recently received by the Museum (see *antea*, p. 317), it seems desirable to place on record the following additional new forms contained in these collections.

Arvicola insperatus, sp. nov.

Apparently not readily distinguishable externally from *Arvicola longicaudus* Merriam, except that the tail is one-third shorter. In cranial characters the two species are widely different. In *A. longicaudus* $\underline{M^2}$ has only four closed triangles, while *A. insperatus* has five, with a shorter and relatively narrower skull; the post-palatal notch is very narrow—little more than half as wide as in *A. longicaudus*, and the zygoma is much heavier—nearly twice as broad as in *A. longicaudus*. There are also many minor differences in the structural details of the skull and teeth, especially in the form of the trefoil of $\underline{M^1}$.

Measurements.—Two adult males measure as follows: Total length, 154 and 168; tail vertebræ, 43 and 41; hind foot, 19 and 20.5 mm.

Two adult examples of *A. longicaudus*, taken at the same time and place as the above, measure as follows: Total length, ♂ (rather young), 180, ♀ (adult), 183; tail vertebræ, ♂, 63, ♀, 62; hind foot, ♂, 23, ♀, 21.

Type, No. $\frac{8105}{6731}$, ♂ ad., Custer, S. D., August 9, 1894; W. W. Granger (Granger Collection).

This species is based on 5 specimens (2 ♂♂ ad., 1 ♀ ad., and 2 ♂♂ juv., about one-third grown), taken at Custer, Black Hills, South Dakota, July 27 to August 11, 1894, by Mr. W. W. Granger.

Lepus texianus eremicus, subsp. nov.

Similar to *L. texianus* (as restricted by Dr. Mearns[1]), but much smaller. No very obvious difference in coloration.

Type, No. $\frac{9034}{7327}$, ♀ ad., Fairbank, Arizona, March 5, 1894; Price and Condit (Price Collection). Total length, 565; tail vertebræ, 74; hind foot, 123; ear from crown, 128 mm.

Dr. Mearns in his discussion (l. c.) of the proper application of the name *Lepus texianus* Waterhouse very properly, I think, restricted it "exclusively to the form west of the Rocky Mountains." In his diagnoses of *Lepus alleni*, *L. callotis*, *L. texianus* and *L. melanotis*, he took for his type and as the basis of his description of *L. texianus* specimen No. 2414, Am. Mus. Nat. Hist., ♀ ad., Fort Verde, Arizona, January 8, 1885 (Dr. E. A. Mearns; orig. No. 163). Fort Verde therefore becomes the type locality of the restricted *L. texianus.*

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[1] This Bulletin, II, 1890, pp. 297–301.

The Hares of the *L. texianus* group appear to be separable, principally on the ground of size, into two forms, a larger northern form, occurring in central Arizona and northward, and a small southern form, found in Southern Arizona (south of the plateau region) and southward into Mexico. Eleven specimens, mainly from Fort Verde, measured in the flesh by Dr. Mearns (see his table, l. c., p. 302) give the following: Total length, 640 (580–660); tail vertebræ, 106 (70–124); hind foot, 145 (130–153); ear from crown, 171 (155–183). Dr. Merriam has published (N. Am. Fauna, No. 3, p. 76) measurements of three specimens from San Francisco Mountain and vicinity which come very close to Dr. Mearns's average of 11 from Fort Verde.

Eight specimens from the southern border of Arizona (Fairbank, Huachuca Mountains, etc.), as measured in the flesh by the collector, give the following: Total length, 580 (535–610); tail vertebræ, 90 (73–104); hind foot, 129 (123–135); ear from crown, 160 (153–170).

NOTE ON **Lepus melanotis** *Mearns.*—The reception of some 20 specimens of *L. melanotis* during the last few months enables me to correct an error made (this Bulletin, VI, p. 169) in reference to some specimens from Rockport, Texas. The Rockport specimens include examples of both *L. callotis* and *L. melanotis;* the latter, in late autumn pelage, were mistaken for the winter phase of *L. callotis.* The two forms are evidently distinct species, whose ranges in Texas overlap. *L. melanotis*, on the other hand, as stated by Dr. Mearns (l. c., pp. 299, 300), is closely related to *L. texianus.*

Lepus sylvaticus pinetis, subsp. nov.

Similar in size and proportions to *Lepus sylvaticus arizonæ*, but much darker in coloration.

Female adult, in worn breeding pelage.—Above as dark as *L. s. floridanus*, but with a rather different general effect. Underfur dark plumbeous at the base, the apical third dark russet brown ; overhair dusky, subterminally broadly ringed with whitish and tipped with black, the color of the upper parts extending well on to the sides of the abdomen. Feet and ears much as in *L. s. arizonæ*, but darker and much more heavily clothed. Pectoral band very much darker, and the fur of the ventral surface much more plumbeous at the base.

Male adult, in fresh post-breeding pelage.—Color above about equally mixed black and whitish gray with a faint tinge of pale buff. Underfur very dark slaty plumbeous, tipped with blackish brown ; overhair basally like the underfur, ringed subapically with soiled whitish and extensively tipped with black. Pectoral band plumbeous, the longer hairs tipped with fulvous gray. Fore feet externally reddish brown ; hind feet much paler.

Measurements.—Total length, ♂, 335, ♀, 425 ; tail vertebræ, ♂, 40, ♀, 58 ; hind foot, ♂, 100, ♀, 105 ; ear from crown, ♂, 69, ♀, 64 mm.

Type, No. $\frac{9041}{7336}$, ♂ ad., White Mountains, August 14, 1894 ; B. C. Condit (Price Collection).

The two specimens on which the above description is based represent a small Hare of the *sylvaticus* group, very different from the ordinary pale form of Arizona and contiguous regions, known as *Lepus arizonæ*, not only in its extremely dark coloration, but in its larger and much more heavily clothed hind feet, and relatively smaller and much more hairy ears. One of the specimens is a female in worn breeding pelage ; the other a male in fresh fall pelage.

Sciurus arizonensis huachuca, subsp. nov.

Similar to *S. arizonensis*, but upper surface nearly uniform gray, showing merely a slight trace of the broad median dorsal area of fulvous seen in *arizonensis*. There is a small nape patch of pale fulvous, and a tinge of fulvous below the surface of the pelage over the middle of the back. The fulvous area of the lower surface of the tail is slightly paler, and there is a greatly reduced amount of fulvous at the base of the hairs of the upper surface of the tail—these features correlating with the reduction in the amount of fulvous on the back.

Type, No. $\frac{9021}{7316}$, ♀ ad., Huachuca Mountains, February 20, 1894 ; W. W. Price (Price Collection). Total length, 540 ; tail vertebræ, 265 ; hind foot, 70 ; ear, 34 mm.

This subspecies is based on 4 specimens, all adult (2 ♂♂, 2 ♀♀), from the Huachuca Mountains, taken January 28 to February 20, by Messrs. Price and Condit. They are very uniform in coloration, and differ widely from a large series of true *arizonensis*, including four January specimens from the type locality of the species.

Sciurus hudsonicus grahamensis, subsp. nov.

Similar to *S. h. mogollonensis*, but slightly yellower and less rufescent above, with the central area of the lower surface of the tail grayish white from the base to the end of the vertebræ, and the base of the hairs of the middle area of the upper surface of the tail yellowish ochraceous, forming a prominent median band of this color.

Type, No. $\frac{9013}{7308}$, ♀ ad., Graham Mountains, Arizona, August 18, 1894; Price and Condit (Price Collection). Total length, 330; tail vertebræ, 132; hind foot, 53; ear, 28.

The three adult specimens from the Graham Mountains, on which this new form is based, measure as follows:

Sex.	Total Length.	Tail Vertebræ.	Hind Foot.	Ear.
♂	325	130	57	28
♂	340	140	56	27
♀	330	132	53	28

A few specimens from the San Francisco and White Mountains show a slight tendency to a grayish median area along the lower surface of the tail, but it is never so pronounced and conspicuous as in the specimens from the Graham Mountains. In true *S. h. mogollonensis* the basal portion of the hairs of the upper surface of the tail are more or less fulvous, but as a rule it is not at all pronounced, whereas in the Graham Mountains specimens it is a conspicuous feature.

While *S. h. grahamensis* is apparently not a very strongly differentiated form it seems to well warrant recognition, especially when considered in relation to its fairly isolated habitat. While the White Mountains form merely the eastern end of the elevated pine plateau extending westward to the San Francisco Mountains, the Graham Mountains are south of the plateau region, from which they are separated by a comparatively low arid plain. Mr. Price (in letter of Oct. 12, 1894) writes: "Finding *Sciurus hudsonius* var.? in the Graham Mountains was interesting. It could not possibly have come in recent times from the White Mountains, as the dry desert of the Gila River lies between. The Graham Mountains rise abruptly from the plain to about 10,500 feet above sea level, and are very isolated."

Article XVI.—ON NEW FORMS OF MARINE ALGÆ FROM THE TRENTON LIMESTONE, WITH OBSERVATIONS ON BUTHOGRAPTUS LAXUS HALL.

By R. P. Whitfield.

Plate XI.

In 1861 Prof. Hall[1] described what he evidently supposed to be a graptolitic body, from shales of the age of the Trenton limestones of New York, found at Platteville, Wisconsin, under the name *Buthograptus*, giving the species *B. laxus* as the type; and in the 'Canadian Organic Remains,' Decade II, on page 49, he mentions it again as "doubtfully" referable to the Graptolitidæ. In the next paragraph he speaks of an associated form having a general resemblance to *Dendrograptus*, and says "without farther knowledge, I refer these fossils, with hesitation, to the genus *Oldhamia* (*O. fruticosa* Hall)."

In working over the fossils described in the 'Report of Progress' of the Wisconsin Geological Survey for 1861, the types of most of which are the property of the Museum, for illustration in the Museum publications, I have become convinced that these remains are not of Graptolitic origin, but are true Marine Algæ.

These bodies are found preserved on surfaces of a brown carbonaceous shale, and are seen on the surface as black lines. When examined under a sufficiently strong glass they are found to be composed of a black, coaly matter, having the lustre and fracture of anthracite, the carbonaceous character of the shale being undoubtedly derived from this source, as there are but few other organic remains found in the same layers with them.

Buthograptus consists of a midrib, flattened as seen on the shale, which gives origin to a series of short, slender, slightly curved pinnules on either edge, somewhat closely arranged, and presents a feather-like aspect as it lies on the rock. There are no definite serratures or cells on either the midrib or on the lateral pinnules, but along the line of the midrib may sometimes be seen a series of dots or punctures which were supposed to represent the apertures of cells, analagous to those of Graptolites, but which now prove to be only depressions in its surface. When the stipe is placed under a sufficiently strong lens it is readily seen that the lateral pinnules are not a part of the central stipe, but are separate organs articulated by a club-shaped end to the central stipe; and it is the imprints of these club-like ends that has produced the punctures that in the description of *Buthograptus* are described as "oval spots marking the form and place of the cellules." No positive evidence has as yet been detected of articulations in the midrib or central stipe, and no really negative proof can be shown. The pinnules where perfectly preserved increase in width outwardly, from just above the club-shaped attachment to nearly twice that width near their extremity, and are rounded or obtusely pointed at the outer end.

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[1] Rep. Prog. Geol. Surv. Wis., 1861, pp. 18 and 19.

The absence of proper cells, taken in connection with the other features above mentioned, led me not only to question the animal origin of *Buthograptus*, but to examine critically the so-called *Oldhamia fruticosa* Hall, which is associated with it, and on placing them under a sufficiently high magnifying power the Algous characteristics were at once detected in their mode of growth and in the jointed bifurcations of the branches. This has led me to the conclusion that they are both of vegetable origin and belong to the true articulated marine Algæ. This was to me a somewhat astonishing result, as I can find no record of any *articulated* marine Algæ described from Palæozoic rocks.

Among the living forms of marine Algæ on the Florida coast and elsewhere we have a form known as *Caulerpa plumaris*, which to the naked eye is so exactly a counterpart of *Buthograptus laxus* that a figure of one would answer equally well for that of the other, but when examined more carefully it is seen that in the living form the lateral pinnules are simply ramifications from the central axis or stipe, while in *Buthograptus* they are articulated pinnules which by maceration were readily separated from the central axis, as is plainly seen in the fossil specimens. The form of *Buthograptus* when living was most probably plumose with a cylindrical axis from which a series of pinnules arose on two opposite sides, not quite opposite to each other at their origin but slightly alternating. These pinnules were probably cylindrical and somewhat club-shaped or enlarging outwardly, and attached to the axis by the knob-like inner end. In the shale, by compression, these rounded parts are all flattened, so there is little left beyond the brown staining on the rock from the carbonaceous material of the plant substance.

The name *Buthograptus* (or *Bythograptus*, as written by several authors) is a misnomer and misleading, as the termination "graptus" seems to ally it with the Graptolitidæ, which we now see to be incorrect. Such a name as *Bythocladus* would be much more appropriate.

Referring again to the supposed *Oldhamia*, I find but little similarity between it and the true *Oldhamia antiqua* Forbes, which occurs fossil in the Cambrian of England, and is the type and only species of the genus, the other species formerly included having been removed under the name *Murchisonites radiatus*. The *Oldhamia antiqua* has been considered by some authors as a Nullipore, by others as a Sertularian; the first a vegetable, the other an animal. The mode of growth seen in these Trenton forms positively indicates their vegetable character.

In very many of the marine Algæ, the stems, branches and branchlets have a peculiar jointed structure, very much like that of a Cactus, with an expansion at the upper end of the joints, the divisions being two, three, or more. This structure is very beautifully shown on some specimens of the one called *Oldhamia fruticosa* by Prof. Hall, especially on the terminal branches. (See Plate XI, Figs. 7 and 8.) Two other forms are found on the same shales, one having long slender stipes with numerous branches, long and filiform, which are joined to the principal stipe by a knob-like end, which is rather set upon the stem than joined to it. These differ entirely from the first-mentioned species, but were included with it in the article in the 'Canadian Decade.' None of them have been positively seen bearing other than the fine filiform branches. A third form occurs which has a strong middle stem, jointed, and having whorls of very fine hair-like pinnules at each joint, and much resembles some species of the genus *Wrangelia*, or perhaps more like *Dasycladus* among our living forms of Algæ.

The occurrence and detection of marine Algæ of a character so very similar to our living forms in rocks of the age of the Trenton limestones of New York, I take to be a matter of some interest and of more than passing importance, as all the various forms of marine plants and sea weeds hitherto described, so far as I am aware, have been so entirely devoid of positive or definite structure, that it is often uncertain whether they may not be the results of worm burrows, tracks or trails of molluscous animals, or phenomena resulting from inorganic causes. But here we have unmistakable structure, as far as external form goes, to guide us in their determination.

Following are descriptions of the new forms here given.

Callithamnopsis,[1] New Genus.

Frond articulate, branched, branches opposite in pairs, or in whorls near the upper end of the joints, and composed of single joints between bifurcations. Type, *C. fruticosa*, Hall's sp. Geological position in the Trenton period.

Callithamnopsis fruticosa.

PLATE XI, FIGS. 4–8.

Oldhamia fruticosa Hall, Can. Org. Rem. Decade II, p. 50. Name only.

Frond consisting of thin filiform stems more or less distinctly jointed, with slender thread-like branches of half or less than half the width of the main stem, the extremities more or less bulbous where they unite with the stem or outer divisions. Outer divisions two or three, or in some cases four or more, diverging at an angle of about thirty degrees from each other, the branches being slightly curved; the whole having the appearance of a densely branched bush in miniature. Stipes and branches with parallel margins.

In some cases the terminal branches only of a frond will be found forming a group together, when they are likely to present the appearance of whorls of many branches from their overlapping and interference one with another, and so present a variety of forms. In one case, what seems to be a main stem with many branches attached, shows the upper terminal point of the stem broad and rounded at the extremity, like a young growing shoot. In some cases the outer branches are short and the bifurcations quite close together, while in others they are long and very slender and the bifurcations quite distant. I have thought these last might possibly be specifically distinct from the type specimen of *C. fruticosa*, but after further study they seem to be connected by intermediate forms enough to unite them as one and the same.

Geological Formation and Locality.—In dark brown or chocolate-colored shales of the Trenton Group, at Platteville, Wisconsin.

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[1] *Callithamnion*, a genus of Algæ, and ὄψις, resemblance.

One peculiar feature noticed by Prof. Hall of some of these bodies, which he referred to *Oldhamia fruticosa*, is that of two of the stems being twisted together like stems of a vine growing and intertwining as if for mutual strength and support. Many of these slender thread-like stems are seen to have this feature. These are long slender stipes sometimes having numerous more slender ramifications. These differ entirely from the one mentioned above under the name *Callithamnopsis*, and cannot well be placed under that genus. So far as seen no true bifurcations, like the terminal parts of that one, have been detected. The branches are attached to the main stipe by a clavate or bulbous base as in that one, but instead of having numerous jointed divisions are simple and hair-like in their extension. This form I shall designate only by specific name, leaving it provisionally under the name *Chætomorpha*, one of our living genera, and give it the specific name *prima* with the following diagnosis.

Chætomorpha ? prima, n. sp.

PLATE XI, FIGS. 9 AND 10.

Slender hair-like plants with continuous stems (*i. e.* not articulated), having numerous more slender filiform branches of extreme tenuity but without known bifurcations or divisions; branches attached to the main stipe or stem by bulbous bases or discs, easily separated. Bifurcations of the main stem uncertain. Stems frequently intertwining.

Geological Position and Locality.—On shales of the age of the Trenton group of New York at Platteville, Wisconsin, associated with the *Buthograptus laxus* Hall and *Callithamnopsis fruticosa.*

A third species, evidently allied somewhat to the preceding, is noticed on three of the blocks which bear the other forms. It is quite distinct in structure as far as can be ascertained, presenting a dense tuft or feather-like form of about one and a half inches in length, and is composed of fine hair-like fibres of great tenuity which diverge from a central stem. On close examination they are seen to be in whorls about a tenth of an inch apart. If this is their true structure the nearest living genus would probably be *Dasycladus* or *Wrangelia.* For this form I would propose the generic name *Chætocladus.*

Chætocladus, New Genus.

Marine plants with jointed cylindrical stems giving off whorls of hair-like filaments at given distances.

Chætocladus plumula, n. sp.

PLATE XI, FIGS. 11-13.

Frond probably sessile, growing in tufts of one or more plume-like stems, composed of a cylindrical axis surrounded at intervals of about a tenth of an inch, by whorls of very fine leaflets presenting a feather-like tuft of three-eighths of an inch diameter.

Formation and Locality.—In chocolate-colored shales of the Trenton group at Platteville, Wisconsin, associated with *Buthograptus laxus* and *Callithamnopsis fruticosa* Hall.

About fifteen years ago, in looking over some fragments of Trenton limestone from Middleville, N. Y., I noticed some specimens resembling Corallines, and so labeled them when placing them in the cabinet, where they have remained until now, awaiting an occasion for further notice. The specimens in question have all the characteristics of the true Corallines of the present seas, and so far as can be ascertained none in which they can be said to differ. Of course they only represent detached portions of the organism, but enough remains to show the prevailing features of the species. Nothing beyond detached joints of this form of marine Algæ has hitherto rewarded the search of Palæobotanists in any of the older geological formations. Detached plates or joints of analogous bodies have been known and described under the name *Cœlotrochium* from the middle Devonian of the Eifel; and in carboniferous limestones of England other but similar bodies have been found in numbers. In the Permian rocks forms pertaining to this class of plants have been described under the generic name *Gyroporella*, while in the Upper Lias, in the Bavarian Alps, beds of limestones are said to be largely made up of *Gyroporella* and *Diplopora.* But no definitely formed organisms of the class have been noticed in the Palæozoic rocks. And it is not until we reach the more modern formations that anything very satisfactory is known of this class of organisms in a fossil state, although it is supposed that calcareous Algæ have aided very largely in the building up of the limestones of all ages. The specimens now in hand consist of branches of from half an inch in length to one and one-fourth of an inch, with a transverse diameter of nearly one-fourth of an inch. They consist of a central or longitudinal axis which is hollow and jointed, and of whorls of lateral branches or pinnules, apparently four, possibly five in number, radiating from the central axis and forming a cylindrical body in the aggregate. The pinnules of the whorls are composed of three elements each ; a first joint which diverges from the central axis gives origin to two secondary joints, while each of these supports two still smaller joints or pinnulæ. For this form I propose the generic name *Primicorallina*, with the following diagnosis :

Primicorallina, New Genus.

Articulated marine plants, consisted of elongated cylindrical fronds, composed of a central longitudinal axis, which is jointed and hollow in the fossil condition, and supports whorls of jointed pinnules from each joint ; pinnules decompound. Type, *P. trentonensis.*

These remains are of course only the calcareous coating of the real plant, the vegetable portion having been lost. The joints are irregular in form but have a generally cylindrical form.

Primicorallina trentonensis, n. sp.

PLATE XI, FIGS. 14–17.

Fronds of small size, represented by cylindrical tufts of greater or less length, and of from one-sixth to one-fourth of an inch in diameter. Axis of the frond irregularly cylindrical and jointed ; the joints count about thirty to the inch and are nearly twice as long as thick. Pinnules four, or perhaps five, from each joint of the axis, composed of cylindrical, oval or clavate joints ; those originating on the axis are of nearly an equal length with the axial joints, and each supports two others on the outer end of very nearly or somewhat shorter length, but of less thickness ; these again support each two others which are short oval in outline and of not more than half the length of the others. Bifurcations of the pinnules diverging at an angle of about thirty to thirty-five degrees to each other.

Geological Formation and Locality.—In Trenton limestone at Middleville, N. Y.

DESCRIPTION OF PLATE XI.

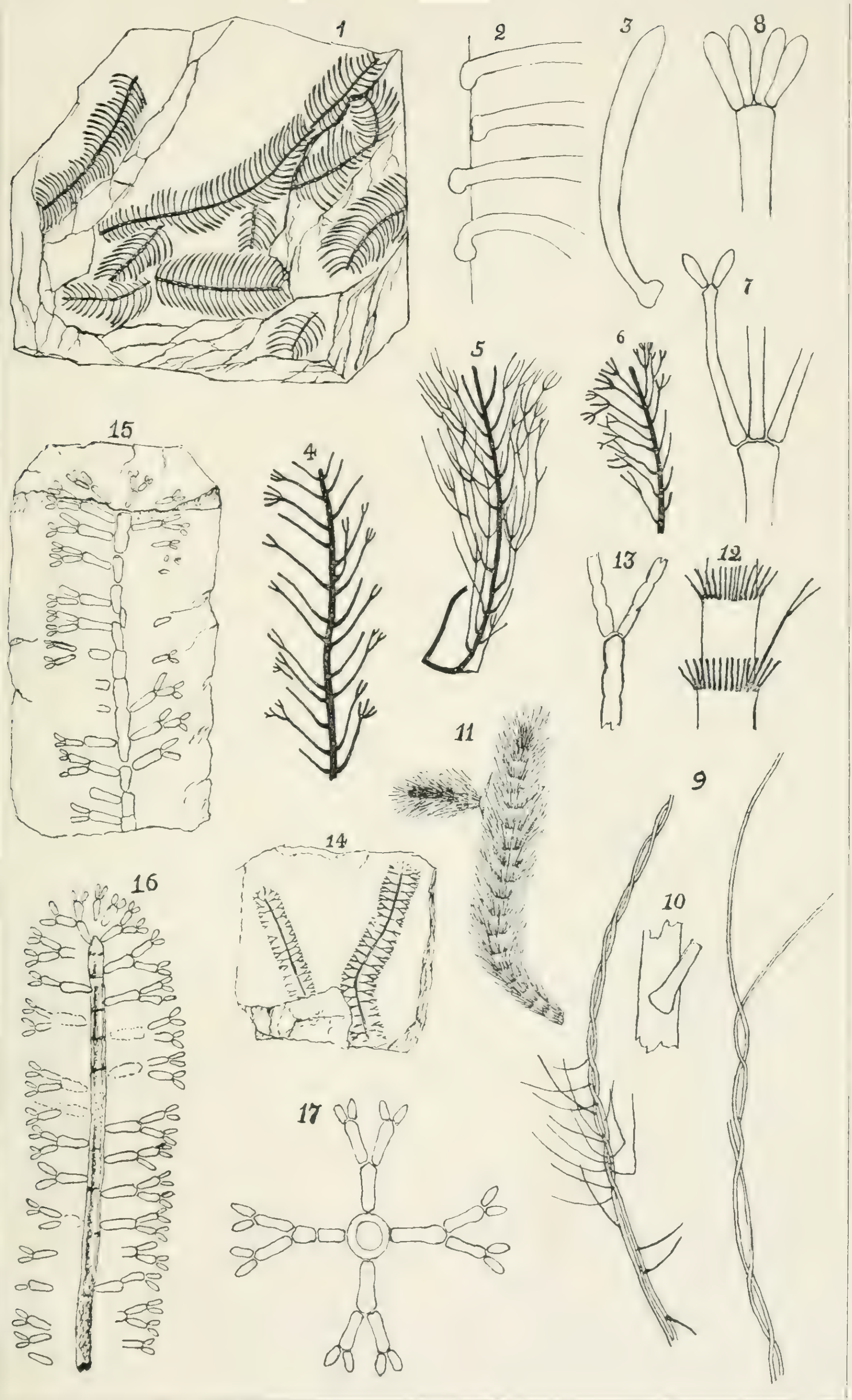
Figs. 1–3. **Buthograptus laxus** *Hall.* Page 351. Fig. 1, view of a block showing several stipes, nat. size. Fig. 2, an enlargement to show the manner of attachment of the pinnules. Fig. 3, a single pinnule enlarged.

Figs. 4–8. **Callithamnopsis fruticosa** *Hall.* Page 354. Figs. 4, 5 and 6, views of three specimens showing variations of form, enlarged 3 times. Figs. 7 and 8, further enlargements of two terminal portions of a fragment.

Figs. 9, 10. **Chætomorpha? prima** *Whitf.* Page 355. Fig. 9, views of two specimens each showing two stipes intertwined, one of which retains the hair-like pinnules; Figs. two diameters. Fig. 10 shows the manner in which the pinnules are attached to the stipe.

Figs. 11–13. **Chætocladus plumula** *Whitf.* Page 356. Fig. 11, view of a branch, nat. size, with a second branch on a lower lamina of shale. Fig. 12 shows the arrangement of the pinnules around the stem. Fig. 13, an enlargement showing a bifurcation and an apparent constricted or jointed character.

Figs. 14–17. **Primicorallina trentonensis** *Whitf.* Page 357. Fig. 14, fragment of shale with two stipes, nat. size. Fig. 15, enlargement 4 times of a specimen in limestone. Fig. 16, enlargement of the smaller stipe on specimen Fig. 14. Fig. 17, diagram showing a sectional view with the arrangement of pinnules around the main stem.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New Forms of Fossil Marine Algæ.

Article XVII.—REMARKS ON A SECOND COLLECTION OF MAMMALS FROM NEW BRUNSWICK, AND ON THE REDISCOVERY OF THE GENUS NEOTOMA IN NEW YORK STATE.

By J. A. Allen.

I.—New Brunswick Mammals.

The Museum has recently received a second collection of mammals from Victoria County, New Brunswick, made by Mr. John Rowley, Jr., mainly during October (Sept. 27–Nov. 7), 1894. The collection numbers about 250 specimens, and contains representatives of several species worthy of note, including two additional to those obtained last year.[1] Besides large series of Marten (*Mustela americana*), Mink (*Lutreola vison*), and the more common smaller mammals, additional specimens were obtained of *Arvicola chrotorrhinus* Miller, and *Evotomys fuscodorsalis* Allen, and the genus *Synaptomys* was found for the first time in New Brunswick.

The following additions and emendations to the former list of New Brunswick mammals (l. c.) are based on Mr. Rowley's second collection, here under notice.

Synaptomys cooperi *Baird*. Lemming Mouse.—Two specimens, taken as follows: Female, young adult, Tobique Point, near Andover, N. B., Sept. 28, 1894. Total length, 117 mm.; tail vertebræ, 22; hind foot, 21.6. Male, young adult, Gulquac Lake, N. B., Oct. 14. Total length, 105 mm.; tail vertebræ, 21.6; hind foot, 21.6.

The capture of these specimens is of special interest, since it extends the known range of the species far to the northward of any previously published localities of its occurrence, the most northern of which are Wareham, Mass.,[1] and Alfred Center, Allegheny Co., New York.[2] In reviewing the known range of this species a few months since[3] I ventured the remark that "It evidently occurs in the East over portions of the country where it has escaped all collectors for half a century, since, as compared with other field mice, it proves to be a singularly difficult species to trap." In securing these two specimens Mr. Rowley estimates that he captured at least 1200 Meadow Mice, of which about 97 per cent. were *Evotomys gapperi*; of these latter of course only a small part were saved.

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[1] See 'Notes on Mammals from New Brunswick, with Description of a New Species of *Evotomys*.' This Bulletin, VI, 1894, pp. 99–106.

Specimens of *Synaptomys cooperi* in the Museum from other hitherto unrecorded localities are examples from Ravenna, Ohio, and Weaverville, North Carolina.

Arvicola chrotorrhinus *Miller.* Rufous-nosed Meadow Mouse.—A single specimen of this species was taken by Mr. Rowley last year (see *antea*, p. 102) at Trousers Lake, N. B. The present collection contains four specimens, three of which were taken at Trousers Lake, Oct. 29 to Nov. 1, and the other at Gulquac Lake, Oct. 16.

Evotomys fuscodorsalis *Allen.* Dusky-backed Meadow Mouse.—This species, based on two specimens collected by Mr. Rowley at Trousers Lake last year (*antea*, p. 103) is represented by a series of 16 specimens. Six were taken at Gulquac Lake, Oct. 12 and 13, and 10 at Trousers Lake, Oct. 27 to Nov. 2. They are very uniform in coloration, and so well agree with the type of the species that no detailed account of them is necessary. They are all apparently nearly full grown. Throwing out two that are not mature, the series ranges in measurements as follows: Total length, 133 (127–140); tail vertebræ, 38 (35–41); hind foot, 20 (19–20.5). One very large specimen greatly exceeds these dimensions, measuring as follows: Total length, 152; tail vertebræ, 46; hind foot, 20.5.

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[1] Bangs, Proc. Biol. Soc. Washington, IX 1894, p. 99-104.
[2] Merriam, *ibid.*, VII., 1892, pp. 175–177.
[3] Abst. Proc. Linn. Soc. New York, No. 6, 1894, p. 17.

Zapus hudsonius (*Zimm.*). JUMPING MOUSE.—Four specimens, Tobique Point, Sept. 27–29. The three specimens of *Zapus* obtained last year were all *Z. insignis* Miller.

Tamias striatus lysteri. NORTHERN CHIPMUNK.—A series of 6 specimens was obtained in crossing the hardwood ridges of Tobique Point, Sept. 27 to Oct. 3, confirming Mr. Rowley's supposition of last year respecting their presence here (*antea*, p. 104).

Blarina talpoides (*Gapper*). SHORT-TAILED SHREW.—Represented by a series of 13 specimens, taken at various points in the region traversed, showing the species to be not uncommon, although only a single specimen was met with last year.

The small Shrew recorded in the former list as *Sorex forsteri* is represented by a series of 62 specimens.

No Moles were collected, but Mr. Rowley obtained satisfactory evidence of the occurrence of the Star-nosed Mole (*Condylura cristata*) at Andover and along the Tobique River.

The Mole recorded in the former list as *Scalops aquaticus* is quite as likely to be *Scapanus breweri*—a point which can only be determined by the capture of specimens.

Procyon lotor (*Linn.*). RACCOON.—An error in the former paper (*antea*, p. 105) respecting the supposed abundance of this species in the Trousers Lake region may be here corrected. The statement there made on Mr. Rowley's authority was based by him on a letter from his Indian guide, whom he had good reason to believe was wholly trustworthy in such matters. It proves, however, that the amanuensis, who wrote from the Indian's dictation, either through misunderstanding or otherwise, inserted the statement in question without the knowledge of Mr. Rowley's supposed informant. Doubtless some other fur-bearing animal was referred to by the Indian guide.

This year Mr. Rowley obtained satisfactory evidence of the occasional occurrence of the Raccoon at Fredericton, N. B., but not in the Trousers Lake region.

II.—REDISCOVERY OF NEOTOMA IN NEW YORK.

Many years since the late Mr. John G. Bell took several specimens of a species of *Neotoma* in the Palisades at Piermont, Rockland County, New York, which were referred by Professor Baird[1] to *N. floridana*. One of these specimens is still extant in the United States National Museum.[2] So far as known to me no Wood Rats have been taken since at this locality, though it is not improbable that they still exist there, and may be taken by proper methods of trapping.

I have now to record the capture of a specimen on Storm King Mountain, Cornwall, Orange County, N. Y., about fifty miles north of New York City, and about forty miles north of Piermont. The specimen was taken in a figure-four trap by my son Cleveland Allen, Oct. 30, 1894, in trapping for game, with other lads of the Cornwall Heights School, on Storm King. The place of capture was at the base of a cliff, thirty to forty feet in height, at an elevation of about 1000 feet. The cliff is full of deep crevices, and has a talus of loose stones at its base. The place is wooded with young second-growth trees, and is in every way well adapted to the needs of *Neotoma*. Although no other examples have thus far been taken, a small colony evidently lives at this locality.

The specimen proves to be a young male, probably a 'young of the year.' It measured as follows before skinning: Total length, 386 mm.; tail vertebræ, 172; hind foot, 41; ear from notch, 31. It differs from *N. floridana* in its densely haired, sharply bicolored tail, which is black above and white below. It thus resembles *Neotoma pennsylvanica* Stone, to which it is doubtless to be referred. Whether this species is to be referred to *N. magister* Baird, as recently claimed by Mr. S. N. Rhoads,[3] may still be an open question, with perhaps the probabilities in favor of Mr. Rhoads's conclusion.

It has often been suggested that the Wood Rats taken by Mr.

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[1] Mam. N. Amer., 1857, pp. 489, 490. He says: "A few specimens of unusually large size were captured some years ago [probably about 1850], by J. G. Bell, near Piermont, on the Hudson River, but I have not heard of any in intermediate localities [South Carolina and New York]."

[2] According to Dr. C. Hart Merriam, in a letter of Nov. 5, 1894.

[3] Proc. Acad. Nat. Sci. Phila., 1894, pp. 213–221.

Bell may have been brought from the South on vessels, and this theory has at last been put in type by Mr. Rhoads, in the following words (l. c., p. 221): "It is doubtful if *N. magister* ever inhabited the State of New York, and the specimens taken by Mr. Bell were probably imported in a cargo of southern lumber." Apropos of this I may state that Dr. Merriam has recently written to me in referring to the capture of *Neotoma* on Storm King (of which I had previously informed him) as follows: "Sometime ago I examined the original Bell specimen from Rockland County and found it to be *N. pennsylvanica*, as I had supposed—thus removing the theoretical objection which argued against *N. floridana* from so far North."

As is well known, there is an early and rather indefinite record of the Wood Rat in Massachusetts. Thus Dr. George Gibbs, in writing of *Neotoma occidentalis*[1] says, incidentally, ... "but evidently confound it with the wood rat, now so rare in the Atlantic States, of which I caught a specimen many years ago in Massachusetts." This record now assumes additional interest from the fact not only of the rediscovery of the Wood Rat in New York State, but from the further fact that I have recently received trustworthy information of the capture, last winter, of six specimens at Liberty Hill, in the northern part of New London County, Connecticut. They came to a barn during severe weather and were captured and thrown away. They were described as large brown rats, *with hairy tails and the belly and feet pure white*—a description of a rat that can only apply to a *Neotoma*. Their peculiarities were noted, but they were regarded as simply "strange rats," their scientific interest being unrecognized.[2]

It hence seems probable that small colonies of Wood Rats may exist at various points in southern New York and southern New England, as well as in New Jersey, Pennsylvania, and in the mountains of Virginia, all probably referable to the recently described *N. pennsylvanica*. If seen, or even captured, unless they should fall into the hands of a competent mammalogist, they would be recognized simply as 'rats,' and fail to excite further interest. Localities suited to the habits of Wood Rats should at least receive careful attention, with the chances quite in favor of isolated colonies being here and there met with quite outside of their heretofore supposed range.

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[1] Nat. Hist. Wash. Terr., Zoöl., p. 128, 1860 (P. R. R. Expl. & Surv., Vol. XII).

[2] I regret to find that the letter conveying this information has been mislaid, and that at this writing I am unable to give the name of my informant, or the exact date of capture of the specimens. The general facts in the case are as above stated, and I have no hesitation in making the record here given.

Article XVIII.—ON NORTH AMERICAN MOTHS, WITH THE DESCRIPTION OF A NEW SPECIES OF TRIPROCRIS.

By William Beutenmüller.

In the current volume of the Museum Bulletin, pages 87–98, I published some notes on North American Ægeriidæ in advance of a contemplated monograph of the family. Since then my studies have been continued, and the following notes are presented, together with a few notes on Bombyces.

Melittia hampsoni *Beuten.*

Melittia grandis Hampson, Moths of India, Vol. I, 1892, p. 203.

The name *Melittia grandis* given to an Indian species by Mr. Hampson is preoccupied by a North American species (*M. grandis* Strecker), and therefore must be changed. I propose for it *M. hampsoni.*

Trochilium pacificum *Hy. Edwards.*

Trochilium pacificum Hy. Edwards, Papilio, Vol. I, 1881, p. 180.
Trochilium californicum Neumoegen, Ent. News, Vol. II, 1891, p. 108.

The description of *Trochilium californicum* exactly agrees with the types of *Trochilium pacificum*, and I propose to unite it with the latter species. Two type males from Santa Barbara, Cal., and two type females, one from San Bernardino, Cal., and the other marked "Cal.," are in the Hy. Edwards Collection. Expanse of males, 25–29 mm. ; of females, 37–41 mm.

Trochilium tibiale *Harris.*

Trochilium tibiale Harris, Am. Journ. Sc. and Arts, Vol. XXXVI, 1839, p. 309; Morris, Synop. Lepid. N. Am. 1862, p. 138 (quotes Harris); Hy. Edwards, Papilio, Vol. II, 1882, p. 53; Packard, Ins. Inj. For. and Sh. Trees, p. 123 (quotes Harris).
Trochilium minimum Neumoegen, Ent. News, Vol. II, 1891, p. 108.

Two examples of this species are in the Edwards Collection, one from Montreal, Canada, and the other from Vancouver Island.

It was originally described from New Hampshire, and was bred from the stems of *Populus* by Harris. In the collection of Mr. Dyar is an example from Yosemite, Cal., and one in Mr. Hudson's collection from Plattsburgh, N. Y. The description of *Trochilium minimum* from Colorado tallies with the examples of *T. tibiale* in the Edwards Collection which, as far as I am aware, were compared with Harris's type in the Boston Society of Natural History.

Sciapteron palmii (*Hy. Edwards*).

Fatua palmii Hy. Edwards, Can. Ent. Vol. XIX, 1887, p. 145.

This species, it appears to me, would be better placed in the genus *Sciapteron*. It was described as a *Fatua*, which was united by me with the genus *Tarsa*[1] of Walker. The species is very closely allied to *Sciapteron simulans* (Grote), and of both only the females are known, which differ generically from *Tarsa* (♀) by having the antennæ of equal width throughout, while those of *Tarsa* are very narrow at the base for some distance then gradually thickening towards the apex, which is pointed at the extreme tip. It is not unlikely that a new genus will have to be erected for *S. palmii* and *S. simulans*, when the males are known.

Sannina opalescens (*Hy. Edw.*).

Ægeria opalescens Hy. Edwards, Papilio, Vol. I, 1881, p. 199.
Sannina pacifica Riley, Insect Life, Vol. III, 1891, p. 292.

The types of *Sannina pacifica* were examined by me, and I find that the male of this species was previously described as *Ægeria*

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[1] Bull. Am. Mus. Nat. Hist., Vol. V, 1893, p. 22.

opalescens. The wings of the male are transparent, with blue-black borders and a transverse discal bar on the fore wings. The joints of the hind legs are tufted with white. The antennæ are minutely pectinated. The fore wings of the female are wholly blue or greenish black, as is also the body and legs ; the hind wings are transparent, with blue-black border. The body of both sexes is blue black, and the venation is the same as in *Sannina exitiosa.*

Habitat : Colorado, Nevada and California.

Albuna pyramidalis (*Walker*).

Ægeria pyramidalis WALKER, Cat. Het. Br. Mus. pt. viii, 1856, p. 40.
Albuna vitrina NEUMOEGEN, Ent. News, Vol. II, 1891, p. 109.

This species is subject to considerable variation, and I have no doubt that the insect described as *Albuna vitrina*, from Fort Calgary, N. W. Territory, is merely one of the many varieties.

Ægeria decipiens *Hy. Edw.*

Ægeria decipiens HY. EDWARDS, Papilio, Vol. I, 1881, p. 197.
Ægeria imperfecta HY. EDWARDS, Papilio, Vol. I, 1881, p. 198.

The types of *Æ. decipiens* and *Æ. imperfecta*, which are before me, are both one and the same species, there being no sufficient characters to warrant their separation as distinct species.

Triprocris lustrans, sp. nov.

Head, body, antennæ and all the wings black with a strong metallic steel-blue reflection. Underside of wings same as above. Expanse, 31 mm. Length of body, 8 mm. One male, from Colorado, Coll. Hy. Edwards, Am. Mus. Nat. Hist.

In color this species resembles *T. smithsonianus*, but is more metallic, and almost twice the size. At first sight it resembles a *Harrisina*, but the wings are considerably broader than in this genus.

Pareuchætes insula (*Walker*).

Halisidota insula Walker, Cat. Het. Br. Mus. pt. iii, 1855, p. 734.
Pareuchætes cadaverosa Grote, Proc. Ent. Soc. Phil. Vol. V, 1865, p. 245.

The type of *H. insula* Walker in the British Museum was examined by the late Hy. Edwards, and his unpublished note on the species says, "*Euchætes insula = E. cadaverosa* Grote."

Habitat: Cuba, Florida, Mexico, and southward.

Lycomorpha centralis *Walker*.

Lycomorpha centralis Walker, Cat. Het. Brit. Mus. pt. ii, 1854, p. 288.
Lycomorpha notha Hy. Edwards, Ent. Amer. Vol. I, 1885, p. 128.

The late Hy. Edwards compared his types of *L. notha* with that of *L. centralis* of Walker in the British Museum, and states in an unpublished note that both are one and the same species.

Habitat: Mexico.

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